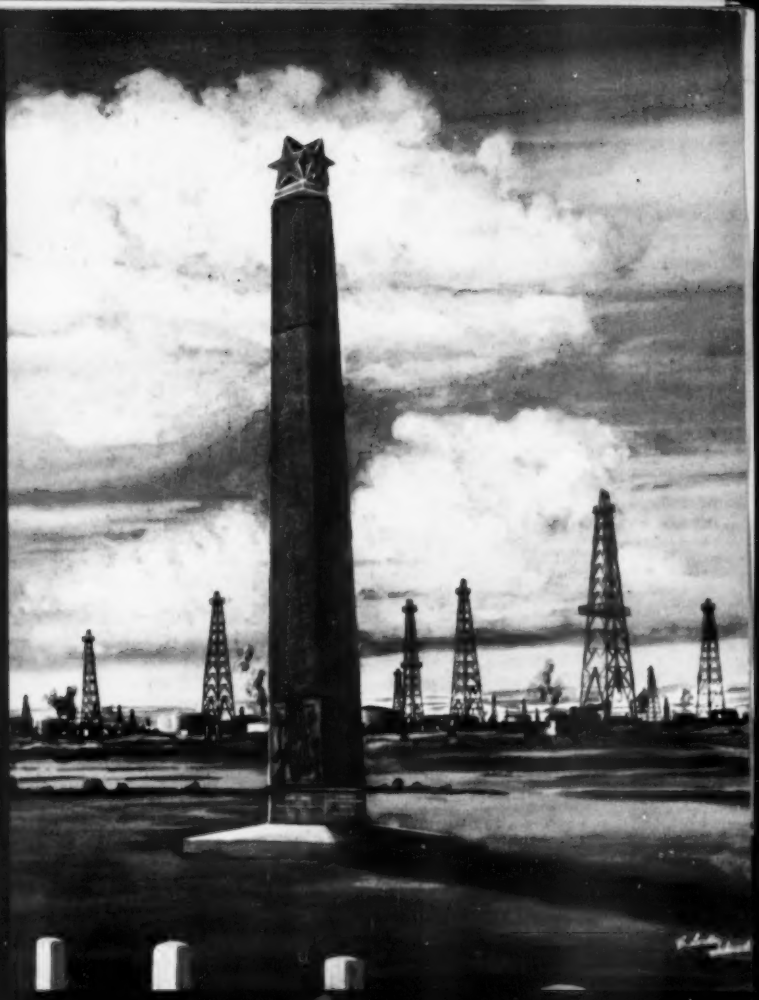
50 YEARS
OF OIL
IN THE
SOUTHWEST



Golden Anniversary

THE OIL AND GAS JOURNAL

STILL DRIVING AHEAD!

We've come a long way together in the last eighteen years. We? That's the oil industry *and* Lane-Wells. Since the day in 1932 which saw the first oil-well perforated by Lane-Wells, both the oil industry and Lane-Wells have grown and progressed —and the end is nowhere in sight.

From the pioneering efforts of the early thirties, the successful development of gun perforating, Lane-Wells has steadily advanced by increasing the scope of its technical services to meet new needs of the industry. Radioactivity well logging, shaped charge perforating, engineered packer service and others have been added, developed and improved to render continually better service to the drilling and producing branches of the petroleum business. Thousands of operators, all across the country, can attest that we have attained a marked degree of success in our endeavors.

But the race is not yet run. Only by continued application to the everlasting problem of improvement can we, at Lane-Wells, maintain our capacity to provide the service you of the oil fields need. And we are doing just that! Research goes steadily onward, questioning, investigating, testing, trying, so that whatever tomorrow's oil country needs may be, Lane-Wells will be ready to meet them. Uncertain though the future may be, one thing is sure: both the oil industry and Lane-Wells will still drive steadily ahead—together.

LANE WELLS

Los Angeles • Houston • Oklahoma City • Lane-Wells Canadian Co. in Canada • Petro-Tech Service Co. in Venezuela

General Offices, Export Office and Plant • 5610 So. Soto St. • Los Angeles 58, California

FIFTY YEARS LATER

When the Spindletop discovery well roared in on January 10, 1901, it marked the beginning of an era that was to make the oil industry a giant among giants. It also marked a date of tremendous importance to rotary drilling, for Spindletop is generally credited with giving the rotary method its first big impetus.

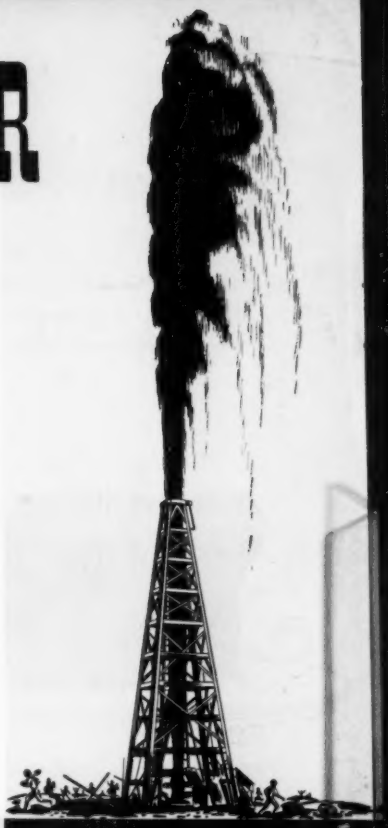
In sinking the well that touched off the Spindletop boom, the drillers used a drawworks, rotary, and swivel made by American Well and Prospecting Company, which eventually was to become a unit of Bethlehem Supply. It took 76 days to bring in the discovery well—a well that by present standards was quite shallow. Using the modern Bethlehem Breeze, a contractor could drill a hole of the same depth in less than three days, including his moving-on and moving-off time.

The Breeze, of course, is the smallest of the six sizes of rigs manufactured by Bethlehem Supply Company—sizes designed and built for shallow, medium, and deep drilling. Each of these outfits reflects the many years of research and development that began even before Spindletop. Each is a rig that will more than do the job for which it is built; a rig that is more than equal to the heavy demands of today's rotary drilling.

BETHLEHEM SUPPLY COMPANY

General Offices: 21 E. Second Street, Tulsa, Okla.
Subsidiary of Bethlehem Steel Corporation

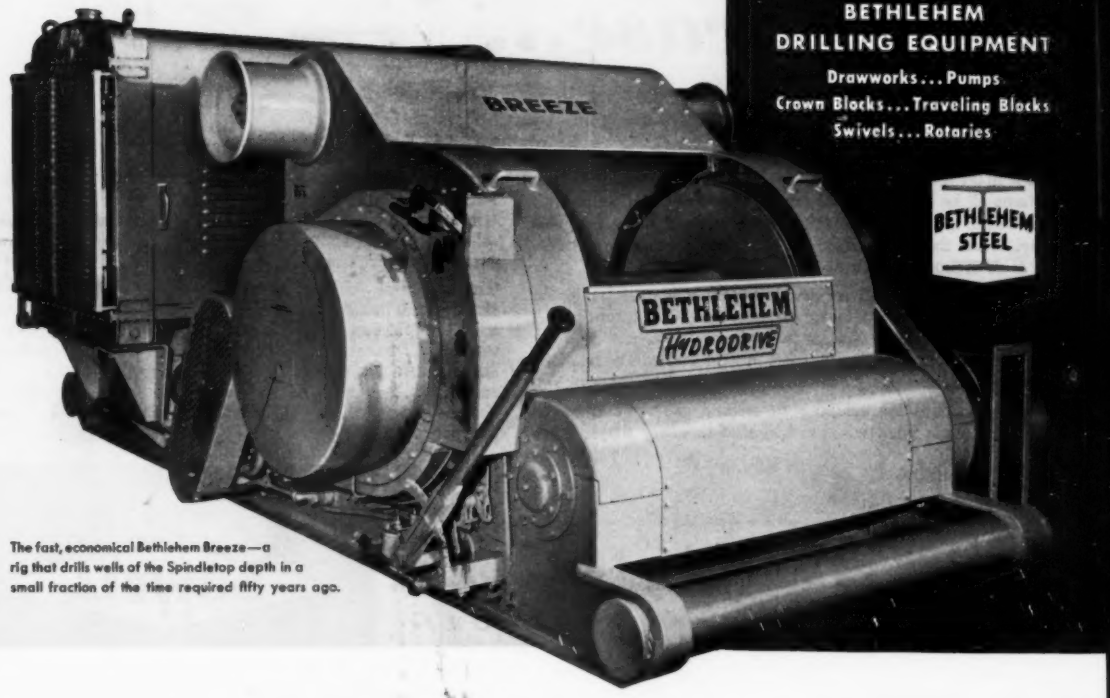
On the Pacific Coast Bethlehem Oil-Field Equipment is sold by Bethlehem Supply Company of California
Export Distributor: Bethlehem Steel Export Corporation



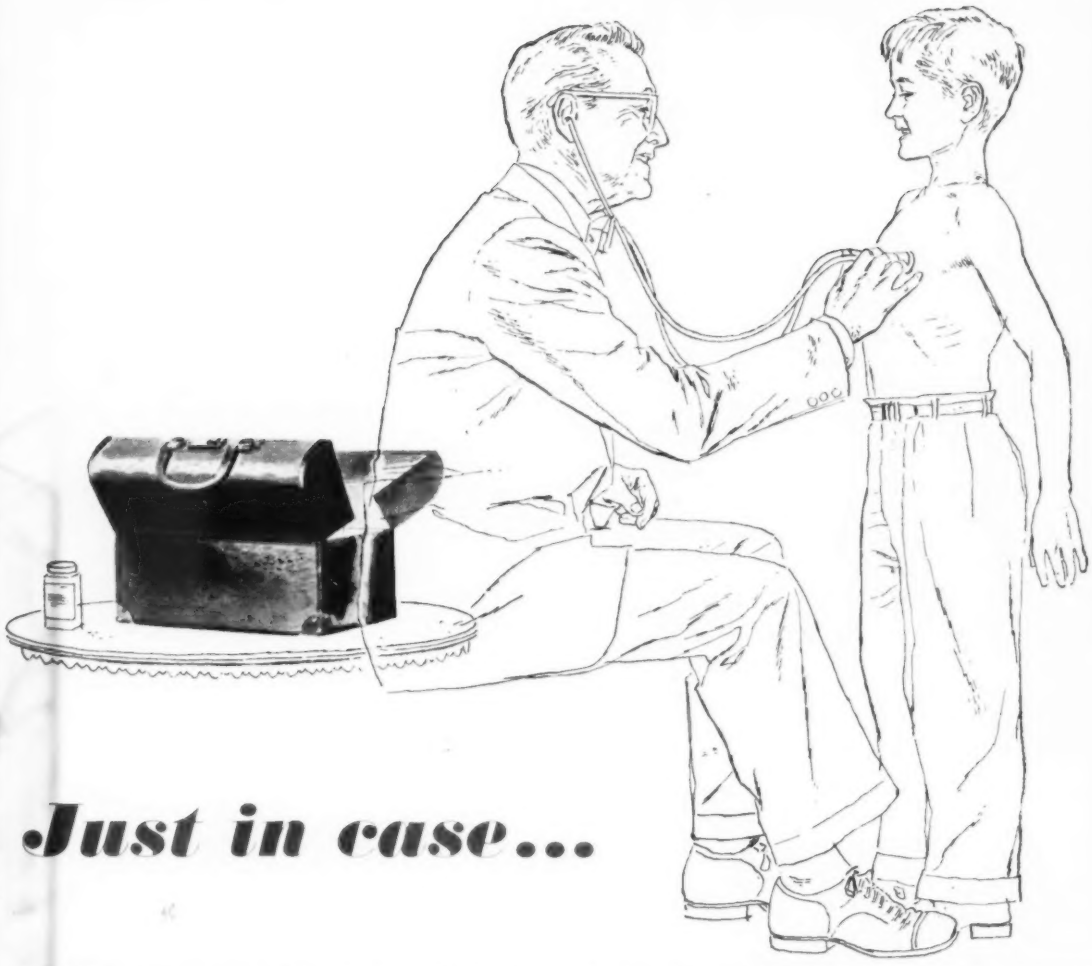
BETHLEHEM DRILLING EQUIPMENT

Drawworks... Pumps
Crown Blocks... Traveling Blocks
Swivels... Rotaries

BETHLEHEM STEEL



The fast, economical Bethlehem Breeze—a rig that drills wells of the Spindletop depth in a small fraction of the time required fifty years ago.



Just in case...

Just a little fever, but you called in the doctor—just in case. Perhaps all he did was write out a prescription for some pink pills, but if it had been serious, it was nice to know Doc was there. What the doctor does is important—*but what he knows how to do* is more important—*just in case!*

An experienced oil well service company is somewhat like a good doctor. What they do on a particular job is important—but, even more important, is what they know how to do—just in case. A great many jobs are routine and can be handled as such. It's those complications that can cause the trouble.

Dowell pioneered the acidizing of oil and gas wells 19 years ago. Since that time, we have operated in every major field, faced nearly every kind of well condition. Such experience has led to the development of many new services, the designing of better equipment, the improvement of techniques, and—above all—has provided the background of ability that is always present . . . just in case.

The next time you buy oil well service, "Look to Dowell" for the dependability and experience that are your assurance of a better job. LOOK TO DOWELL FOR ACIDIZING . . . ELECTRIC PILOT . . . PERFO-JET . . . PLASTIC SERVICE . . . CHEMICAL SCALE REMOVAL FOR HEAT EXCHANGE EQUIPMENT . . . JEL-FLAKE . . . PARAFFIN SOLVENTS . . . MAGNESIUM ANODES FOR CORROSION CONTROL . . . SARAN RUBBER LININGS . . . BULK INHIBITED ACID.

Dowell Incorporated

TULSA 3, OKLAHOMA

A Subsidiary of The Dow Chemical Company

Look to DOWELL

FOR OIL INDUSTRY CHEMICAL SERVICE

The Oil and Gas Journal

GOLDEN ANNIVERSARY NUMBER....MAY 1951

Supplement to the issue of May 31, 1951
Vol. 50 No. 4

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C. O. WILLSON
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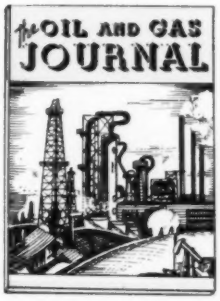

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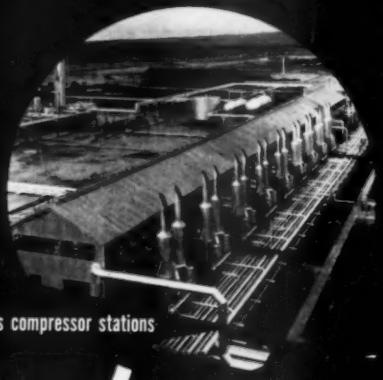
PETROLEUM PUBLISHING COMPANY, TULSA, OKLAHOMA

In the 50 years since Spindletop

gas treating plants



gas compressor stations

SINCE
1890

natural gasoline plants

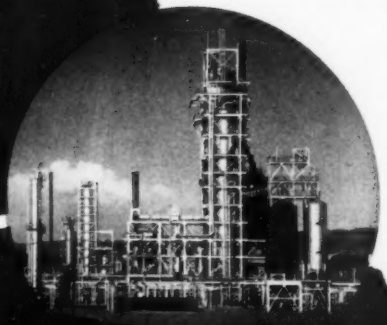
crude oil units

processing units

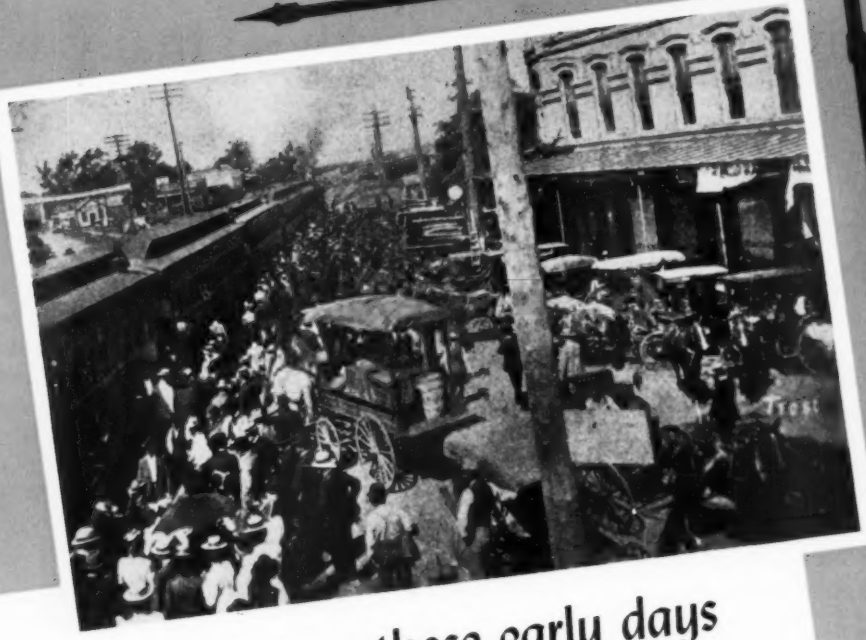
petroleum industry in these many ways

The steady growth of The Fluor Corporation goes hand-in-hand with that of the petroleum industry since the first *big* discovery of Texas oil at Spindletop. Fluor's engineering and construction personnel were engaged primarily in heavy industrial construction just prior to Spindletop. Soon after Spindletop, the company's engineering and construction skills found ready acceptance by the rapidly expanding petroleum industry.

First contracts called for the design and construction of gas compressor stations. Next came work in gasoline processing plants. Then followed the design, engineering and construction of major refining units. Today Fluor is recognized as one of the nation's major engineering and construction organizations. Whatever your plans might include—a completely integrated plant or the expansion of existing facilities—Fluor's accumulated experience in the petroleum refining, gas-gasoline and chemical processing industries is at your disposal.



catalytic cracking units



. . . and since those early days at Spindletop

Oil Well Supply Company has kept faith with the Industry by pioneering in the design of countless tools and devices that have contributed to its progress—including such developments as:

1. **Oilbath Swivels**
2. **Make-and-break Rotaries**
3. **Rotaries with one-piece base**
4. **Geared Powers and Geared Pumping Units**
5. **Twin-Cylinder Steam Engines with one-piece frame**
6. **Sucker Rods with upset ends**
7. **Fully heat-treated Sucker Rods and Pull Rods**
8. **Differential Drilling Drives**
9. **Rotary Drilling Units—Steam and Internal-Combustion Engine Driven**
10. **Hydraulic Feed Control which now automatically maintains pre-selected weight on the drilling bit**
11. **Portable Derrick that "walks" onto sub-base**

In these developments "Oilwell" gratefully acknowledges the aid of the many operators, engineers, drillers and other oil men who assisted in the creation of these improvements.

Wherever there's OIL — there's "OILWELL"

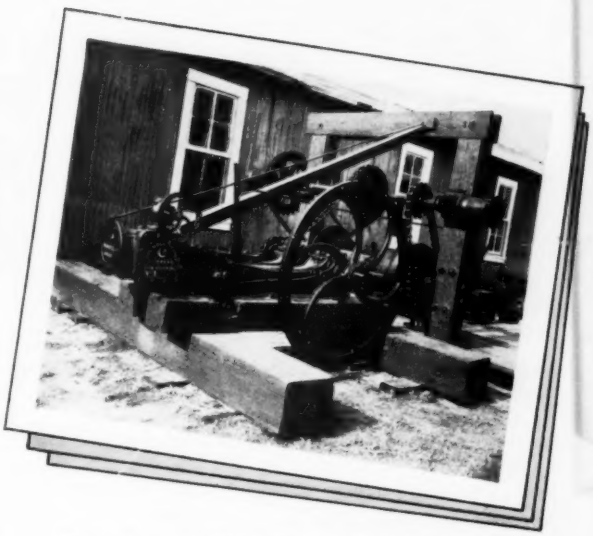
PINDLETOP

"Oilwell" was THERE!

Compared . . . with modern drilling rigs, Al W. Hamill didn't have very powerful equipment to drill the Lucas Gusher. Power was supplied by one 25 HP Boiler and a single-cylinder "Oilwell" Steam Engine.

"Oilwell" . . . was there from the very beginning—with a Supply Store in Beaumont shortly after the Spindletop discovery.

Today . . . as throughout the 89 years since "Oilwell" began operations after Drake's discovery well . . . "Oilwell" Stores continue to follow important oil discoveries—supplying machinery and equipment for a Progressive Petroleum Industry.



This is the type of "Oilwell" engine that was on the Lucas Gusher when it "blew in" January 10, 1901. A complete rig, such as was used in those early days, has been re-constructed commemorating Spindletop's 50th Anniversary.

OIL WELL SUPPLY COMPANY

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Executive Office—DALLAS, TEXAS
Export Division Office—
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"OILWELL"

TRADE MARK

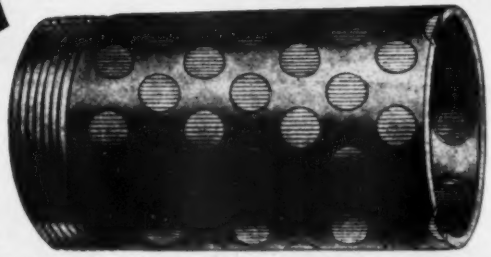
UNITED STATES STEEL

THEN AND NOW... McEvoy LEADS THE FIELD

OIL INVESTORS' JOURNAL February 3, 1907

1907

McEVOY'S WIRELESS STRAINER



Can Be Rotated or Driven

For Oil and Water Wells

Manufactured by

J. H. McEvoy & Co.

Houston, Texas

Prices and Samples on Application

McEvoy EXPERIENCE PARALLELS THE OIL INDUSTRY...

45 YEARS IN DESIGN AND DEVELOPMENT OF OIL PRODUCING EQUIPMENT

1907 J. H. McEvoy & Company was a leading manufacturer of oil well strainers, screen and related production equipment. Through years of close cooperation with the oil industry, McEvoy engineering has kept constant pace with changing requirements . . . designing advanced equipment to reduce the cost of producing oil.

1951 McEvoy's unparalleled fund of experience has produced the outstanding line of McEvoy Automatic Lubrication Conduit Gate Valves.

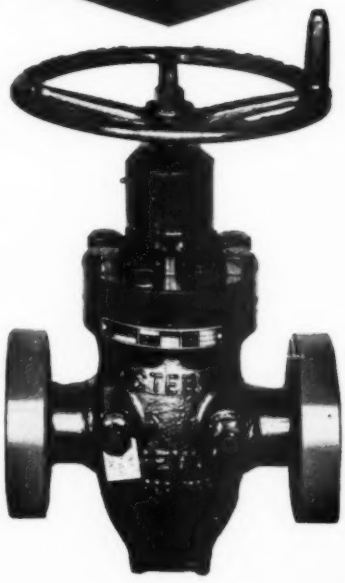
The McEvoy Valve incorporates many advanced features that reduce valve costs. It is easy to operate, yet seals positively without wedging. Automatic lubrication stops leaks before they start; and chrome-plated sealing surfaces minimize corrosion troubles.

For severe corrosion conditions, McEvoy all stainless Macaloy Valves are available.

Eight years of field service have proved McEvoy Valves to be the safest, longest-lasting and most economical valves available today.

McEvoy Valves are made in a complete line of sizes and pressure ratings for Christmas trees, flow-lines and cycling plants. Write for full information.

1951



McEvoy COMPANY

TEXAS AND MILBY ST. • P. O. BOX 3127 • HOUSTON 1, TEXAS

Export Representative: E. F. Gahan, Inc.,
Room 1223, 500 Fifth Avenue, New York, N. Y.

2740

The Pay-off Is Achievement

Can you imagine what the tempo of American life would be today without the progressiveness of modern oil technology? Petroleum achievement represents a brilliant chapter in the development of industrial civilization as we know it, for it is largely through that achievement that a substantial segment of our national economy literally runs on oil. The industry's devotion to scientific research and better methods has paid off in prosperity and better living standards for all Americans.

Throughout these years of progress the Guaranty Trust Company has been privileged to serve in many important ways in financing the petroleum industry. Our intimate knowledge of special problems and our broad experience gained in solving them are at the full disposal of the industry.

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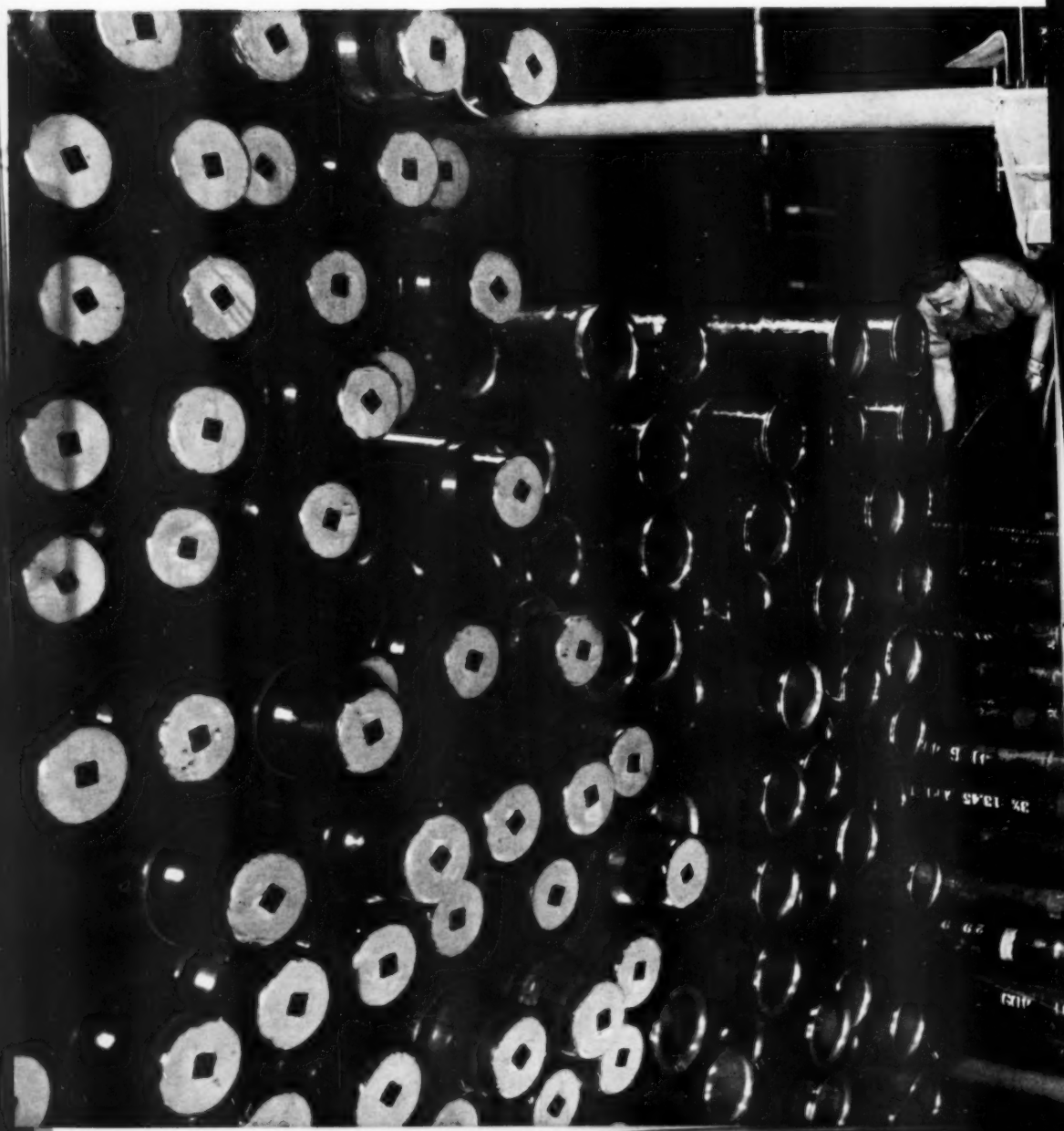
It takes the **FINEST SEAMLESS**

and lots of it . . . to serve the oil and



STEEL PIPE . . .
gas industry *and YOU!*

J&L STEEL

J&L workmen load a shipment of seamless drill pipe, casing and tubing for the oil country.

IDENTIFICATION BY COLOR

Blue End (with yellow thread protector)—Full-Hole "Blue Ribbon" I-J Drill Pipe with 6" O.D. Box.

Red Coupling with Red Band—N80 Casing.

Blue End with Red Band—Internal Flush "Blue Ribbon" I-J Drill Pipe.

(Caps with square holes are thread protectors that prevent damage in transit to well site.)

Color photograph by Art d'Arazien. Sketches by E. P. Couse.

Chances are you never bought a length of this kind of pipe in your life, because it is special alloy-steel seamless pipe used by one of America's indispensable producers of power...the oil and gas industry.

Vast quantities of steel pipe like that illustrated at the left play a vital role on the home front and on the fighting front. Fuel oil and lubricants that keep industry's powerful machines operating smoothly and efficiently; fuel for the trains and buses that carry you and for the trucks that bring you food and other supplies; natural gas and oil for your home; gasoline and oil for your car—all these are at your service night and day, year in and year out, because of steel pipe.

Much of the pipe that works these wonders for you bears the J&L name—patented Integral-Joint "Blue Ribbon" drill pipe; seamless steel casing, tubing and line pipe . . . a complete range of pipe needed to drill and case the well, bring the oil or gas to the surface and transport it to you.

Made in modern mills under strict quality-control methods, J&L oil country drill pipe, casing and tubing are built to take terrific punishment . . . extreme pressures as great as 10,000 lb./sq. in . . . forces of 200 tons on pipe thread connections. . . . months of strain from twisting and drilling.

Only the finest seamless steel pipe, especially designed for the purpose, can meet these exacting demands. That's why J&L steel pipe serves the oil and gas industry so well and why it is an important influence upon your daily comfort, convenience and safety.

The completion of the Lucas Well at Spindletop on January 10, 1901, marked the beginning of fifty years of remarkable progress by the oil and gas industry. Our hats are off to the industry and to the OIL & GAS JOURNAL for its excellent coverage of this progress. As a supplier of high-quality steel pipe, J&L takes pride in having taken part in the growth of this expanding industry.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

NATIONAL TANK COMPANY
1926
25
YEARS OF SERVICE
1951
TULSA OKLAHOMA

FOR RIGHT POWER,

IT'S FORD POWER!

The Ford Industrial Engine Department congratulates its partner in progress, the Oil and Gas Industry of Texas, on the 50th Anniversary of the Spindletop discovery.

Now, more than ever, Ford Power is the *right* power in the oil and gas field with its complete line of POWER UNITS. And there are the rugged Ford Industrial Engine Assemblies, too, that fill a variety of applications.

Ford

"254" POWER UNIT

254 cu. in. displacement, 6 cylinders

(Also available in open type power unit or engine assembly only.)

Whichever you choose, you're right 3 important ways with Ford Power

1. **RIGHT POWER** for your job—five great models available in both Power Units and Engine Assemblies alone.
2. **RIGHT FEATURES**—all the latest advancements of Ford's famed progressive engineering.
3. **RIGHT SERVICE**—as near to you as your nearest Ford Dealer.

Specifications of Ford Industrial Engine-Power Units

Model	Cylinders	Bore and Stroke	Displ. cu. in.	Dyn. B.H.P.	Max. Torque	Equipment Available
120	4	3⅛ x 3¾	120	38 @ 2400	92#' @ 1400	Clutch; SAE #5 housing; power take-off; Ford housing; 3- or 4-speed transmission; governor. (Available as closed type power unit or engine assembly.)
226	6	3.3 x 4.4	226	80 @ 2400	182#' @ 1200	Clutch; SAE #3 or #4 housing; power take-off; Ford housing; 3-, 4- or 5-speed transmission; governor. (Available as closed or open type power unit, or engine assembly.)
239	V-8	3⅛ x 3¾	239	85 @ 2400	187#' @ 1600	Clutch; SAE #3 or #4 housing; power take-off; Ford housing with 3-, 4- or 5-speed transmission; governor. (Available as closed or open type power unit, or engine assembly.)
254	6	3.5 x 4.4	254	95 @ 2400	212#' @ 1200	Clutch; SAE #3 or #4 housing; power take-off; Ford housing; 3-, 4- or 5-speed transmission; governor. (Available as closed or open type power unit, or engine assembly.)
337	V-8	3½ x 4⅜	337	117 @ 2400	257#' @ 1600	Clutch; 5-speed direct-in-fifth transmission; overdrive transmission, direct drive power take-off. (Available as closed or open type power unit, or engine assembly.)

With Ford Power you have five sizes to choose from. All engines and power units are tested, complete and ready to run. Wide variety of specially designed drive combinations and equipment are available to meet the requirements of individual installations.

Our experienced Sales Engineers are at your service in developing engineering recommendations for the most efficient use of Ford Industrial Power in your application. Simply write direct to the Ford Industrial Engine Sales Department.

INDUSTRIAL ENGINE DEPARTMENT

Tractor & Industrial Engine Division

FORD MOTOR COMPANY

15050 Woodward Avenue, Highland Park 3, Michigan

Ford

INDUSTRIAL ENGINES YOUR JOB IS WELL-POWERED WHEN IT'S FORD-POWERED!

SPINDLETOP
–where a January morning changed your way of life

At 10:30 A.M. on January 10, 1901—just fifty years ago—the mightiest oil well the world had ever seen roared into being. This well at Spindletop, near Beaumont, Texas, was the first of a series of fabulous oil discoveries that gave the people of America a new vision of what their supply of oil might be.

Even more important, the roar of Spindletop was the starting gun in a great race where thousands of oil companies tried to outdo each other in producing more efficient, less expensive fuels for the newly developed automobile and oil burner.

Better, cheaper fuels helped put these "luxuries" within the reach of millions . . . and helped make popular the Diesel engine, the harvester-thresher combine, the airplane and thousands of other developments that have bettered America's way of life.

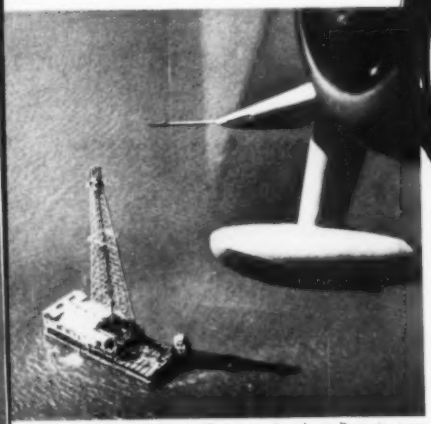
In peace or war, America's privately-managed oil companies provide the finest oil products at the world's lowest prices.

The price of gasoline, for example, is about the same as it was 25 years ago *but* it is so much better in quality that 2 gallons of today's gasoline do the work that 3 gallons used to do.

This amazing progress has come because free men, competing freely, have out-distanced the world in their race to out-distance each other. *And the benefits of this race go to you.*

Oil Industry Information Committee
AMERICAN PETROLEUM INSTITUTE
50 West 50th Street, New York 20, N.Y.

CAPT. LUCAS' WELL at Spindletop gushed up 200 feet before it could be controlled. Today's oilmen use an amazing system of gauges and valves which guard against loss. Competition calls for efficiency and the results of this efficiency are passed on to you in finer products for your car and home at the world's lowest prices.



OIL DRILLING beneath the ocean floor, as seen from the air. By tapping ocean, mountain and desert sources, America's oil reserves keep us strong. Due to the great competition in the search for oil, America's underground oil supplies today are highest in history, 8 times as large as in Spindletop's day.

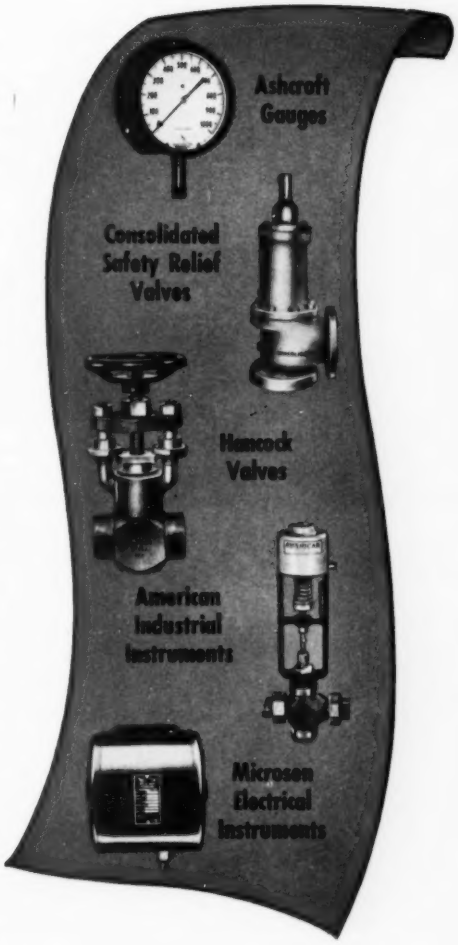
1951 WILL SEE AMERICA with fifty million passenger cars, trucks and buses—to say nothing of Diesel engines and airplanes. It's an all-time—all-world—high. Thanks to oil rivalry, the price of gasoline today is about the same as it was 25 years ago—but the gasoline is worth 50% more by every measure of automobile performance and economy.

. . . "Today's Oilmen use an amazing system of GAUGES and VALVES which guard against loss"

As spectacular and fundamental in many ways as the discovery of "Spindletop" on January 10, 1901, is the engineering and product development of the country's gauge, valve, and instrument manufacturers of which Manning, Maxwell & Moore, Inc., is proud to be a part.

Not only do these "*amazing systems of gauges and valves*" guard against loss, they also contribute to the smooth efficiency, high production standards, and low cost of the products of America's vital petroleum industry.

Here at Manning, Maxwell & Moore, Inc., the consistent advancement of the oil industry has played an exciting part in our own history. Our gauges, valves, and instruments have been proved and accepted by "oilmen" since the industry's earliest days. And with research and product development at a high level, we are confident of our ability to continue to serve—economically and efficiently.



MANNING, MAXWELL & MOORE, INC.

BRIDGEPORT 2, CONNECTICUT

Makers of 'Ashcroft' Gauges, 'Hancock' Valves, 'Consolidated' Safety and Relief Valves, 'American' Industrial and 'Microsen' Electrical Instruments. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load Lifter' Hoists and other lifting specialties.

AEROTEC

DRY SCRUBBER

uses no liquids to scrub natural gas

The phenomenal growth of the natural gas industry has presented problems of cleaning gas both at the well, in transmission, and at distribution points.

Aerotec offers a solution to these problems by the use of small diameter centrifugal tubes removing foreign matter, solids and liquids, leaving the gas dry and clean.

Hundreds of installations prove this method to be a most effective way of scrubbing natural gas. Installations, such as the Texas Eastern Transmission Corporation Station shown above, handle millions of standard cubic feet of gas every day. In the Aerotec Gas Scrubber, the gas is cleaned without using any liquid as a scrubbing medium. Many natural advantages accrue to this method. The use of Aerotec Scrubbing elements in high pressure casings provides a safe, simple method of scrubbing gas.

Why not talk over your problems with our Project Engineers. Their wide experience in the industry will be of inestimable value to you. Write for catalog No. 501.

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GREENWICH, CONN.

Manufacturers

THE AEROTEC CORPORATION
GREENWICH, CONN.

LEE C.

Moore

drilling structures since 1907

For 44 years Lee C. Moore has pioneered new and improved drilling structures that have found ready acceptance in the oil industry. Moore Derricks have been used to drill the world's deepest wells, and Moore Masts have drilled below 15,000 feet. Look to Lee C. Moore for continued leadership in developing all types of drilling structures for use the world over.

LEE C. MOORE CORPORATION

TULSA • DALLAS • HOUSTON • MIDLAND • SHREVEPORT • WICHITA • CENTRALIA • PITTSBURCH

Export Office—9 Rockefeller Plaza, New York 20, N. Y.

ACCO

TRADE MARK

Consider . . . the advantages . . . of purchasing products made by American Chain & Cable for use in the oil fields and refineries:

- ACCO district offices in principal oil centers
- Nearby distributors to serve you
- Years of experience manufacturing products for the oil industry
- Wide range of engineering practice
- Manufacturing responsibility and a determination to make ACCO products *"intentionally better"*

for information on the ACCO oil field products illustrated

Ever Since . . . and Before SPINDLETOP . . . factories, now joined together as Divisions of the American Chain & Cable Company, Inc., have manufactured and improved products under brand names which today are held in high regard by the oil industry.

Here are their names . . . and what they make:

AMERICAN CABLE DIVISION

Tru-Lay Preformed Wire Rope
Crescent Non-Preformed Wire Rope
Rotary, Cable Tool, Tubing, Bailing, Sand, and Winch Lines
ACCO Registered Wire Rope Slings

AMERICAN CHAIN DIVISION

Welded and Weldless Chain
Spinning, Boomer, and Winch Line Tail Chains
Tow Chains
Weed Tire Chains
ACCO Registered Sling Chains

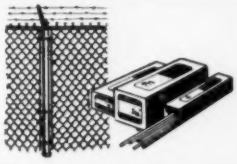
HAZARD WIRE ROPE DIVISION

Lay-Set Preformed Wire Rope
Nonparell Non-Preformed Wire Rope
Cable Tool, Rotary, Tubing, Bailing, Sand, and Winch Lines
ACCO Registered Wire Rope Slings

HELICOID GAGE DIVISION

Helicoid—the Pressure Gage of enduring accuracy
Only Helicoid Pressure Gages have the Helicoid movement

PAGE STEEL AND WIRE DIVISION



Page Chain Link Fence
Page Stainless Steel Strand
Page Stainless Steel Welding Electrodes

R-P & C VALVE DIVISION

Bronze, Iron, and Cast and Forged Steel Valves
Bar Stock Valves
Cast Steel Fittings

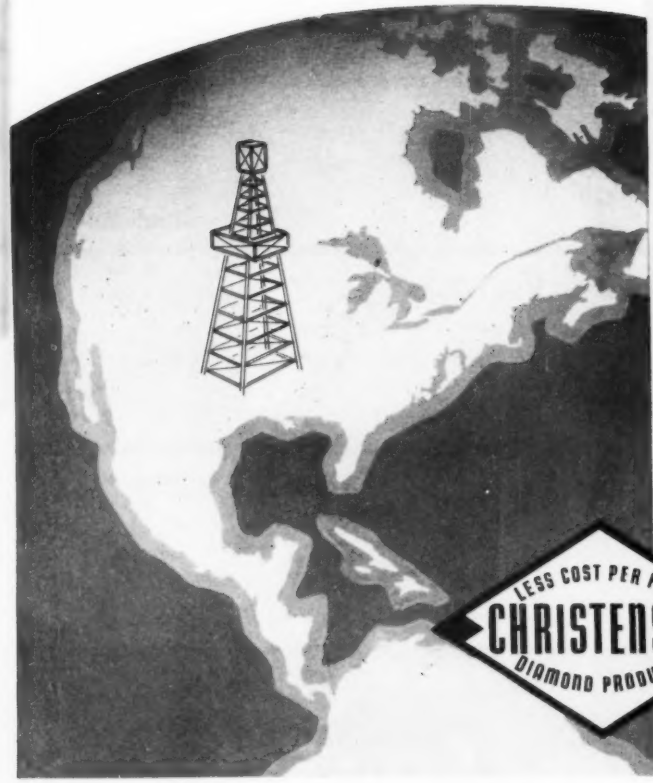
ACCO

AMERICAN CHAIN & CABLE COMPANY, INC.
BRIDGEPORT, CONNECTICUT

. . . to have been a factor in the development of the Oil Industry, which has grown so rapidly since the Spindletop Discovery in 1901.

. . . to have established new techniques and diamond core bit equipment for the industry which has helped open new horizons in reservoir information, faster penetration, full core recovery and drilling at less cost per foot.

. . . of their nine base points of operation and twenty-eight field service engineers who are on the job to give you the necessary assistance and service where needed.

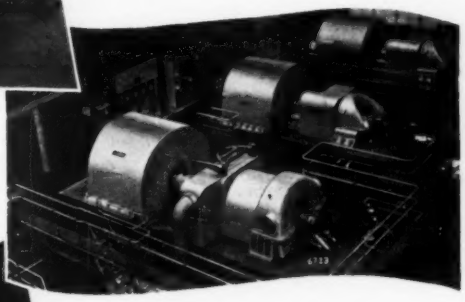


CHRISTENSEN
DIAMOND PRODUCTS CO.

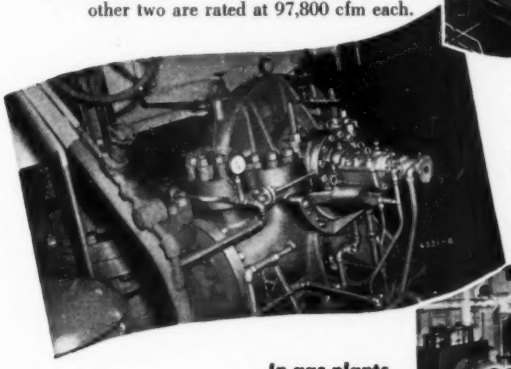
1937 SOUTH 2nd WEST
SALT LAKE CITY, UTAH

for Continuous Operation specify De Laval heavy Duty Blowers!

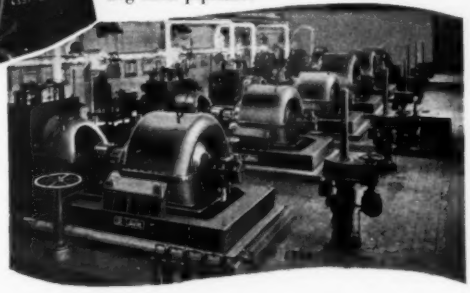
In refineries
This 1910 hp, 17,800 cfm De Laval Turbine Driven Blower supplies air for catalyst regeneration in a fluid catalytic cracking plant.



In steel plants
These three De Laval Blast Furnace Blowers serve one of America's leading steel plants—the largest unit is rated at 123,00 cfm against 33.3 psig. The other two are rated at 97,800 cfm each.



On pipe line service
This De Laval single-stage compressor pumps gas through the Little Inch pipeline at 850 psi. Similar De Laval units also are giving continuous trouble-free service at this high pressure on the Big Inch pipeline.



In gas plants
Three De Laval coke oven boosters and three coke oven exhausters installed in an Eastern Steel Mill.
Send for catalog.

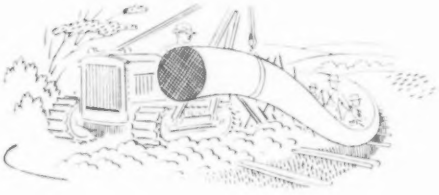
50th DE LAVAL Anniversary

DE LAVAL STEAM TURBINE CO.
TRENTON 2, N. J.

C-16

THE STORY OF NATURAL GAS IN OKLAHOMA!

Back in 1896, Oklahoma's pioneer industries could be counted on the fingers of one hand. But as markets expanded and the oil and gas industries developed, Oklahoma began to grow. Cotton gins, brick plants, canning factories, laundries and hundreds of other commercial establishments mushroomed almost over night—and all of them used natural gas for fuel.



Today, Oklahoma offers industry and commerce even greater opportunities. Healthful climate, abundant resources of Natural Gas at lowest rates, skilled labor and capital, all combine to make Oklahoma one of the most attractive locations for new industry in the southwest.

As Oklahoma has grown in population, so has it grown industrially and commercially. Step by step industry, commerce and Oklahoma have marched hand in hand through the last 55 years. Each has contributed to the other's growth, and one of the most interesting sidelights in their rapid progress is the part Natural Gas has played in this drama of development.

Transportation facilities also grew. Railroads laid lines through Oklahoma to points south and west. Trucking companies sprang up. And to meet growing demands for a growing Oklahoma, new gas mains were laid from newer, larger fields.

OKLAHOMA NATURAL
Gas Company

PASSPORT

for Petroleum Products

● Long before the turn of the century representatives of Charles Martin & Company had started building a reputation for dependable petroleum inspection. Now, petroleum products move unchallenged throughout the world on "passports" issued by Charles Martin & Company offices and laboratories. We invite inquiries to any of the strategically located offices . . . located to provide the best in petroleum inspection and tank calibration.

Chas. MARTIN & Company

New York, N. Y.
Boston, Mass.
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New Orleans, La.
Baton Rouge, La.
Lake Charles, La.
Port Arthur, Texas
Beaumont, Texas
Houston, Texas

Baytown, Texas
Texas City, Texas
Freeport, Texas
Corpus Christi, Texas
Brownsville, Texas
Helena, Ark.

San Pedro (Part of Los Angeles), Calif.
San Luis Obispo, Calif.
San Francisco, Calif.
Tampico, Mexico
Havana, Cuba

Aruba & Curacao, N. W. I.
Trinidad, B. W. I.
Caripito, Puerto La Cruz
Las Piedras, Venezuela
Ras Tanura, Saudi Arabia

First

SUPPLY BOVAIRD COMPANY

80 years of progress with the Oil Industry

In 1871, soon after Col. Drake drilled the first oil well, Bovaird entered the oil field supply business. For 80 years, Bovaird has rendered a friendly, sincere service to the oil industry.

To keep pace with petroleum, the Bovaird organization has constantly applied its experience and its knowledge of field conditions and needs to improve and enlarge its facilities.

Today, 22 strategically-located stores and offices are ready to serve you promptly with the finest nationally-known brands of supplies and equipment available.

OFFICES AND STORES

ILLINOIS—Clay City, Grayville, Salem
KANSAS—Chase, Great Bend, McPherson Pratt, Russell, Wichita
OKLAHOMA—Duncan, Oklahoma City, Pauls Valley, Ringwood, Sapulpa, Seminole, Tulsa
TEXAS—Borger, Dallas, Midland, Odessa, Pampa, Snyder

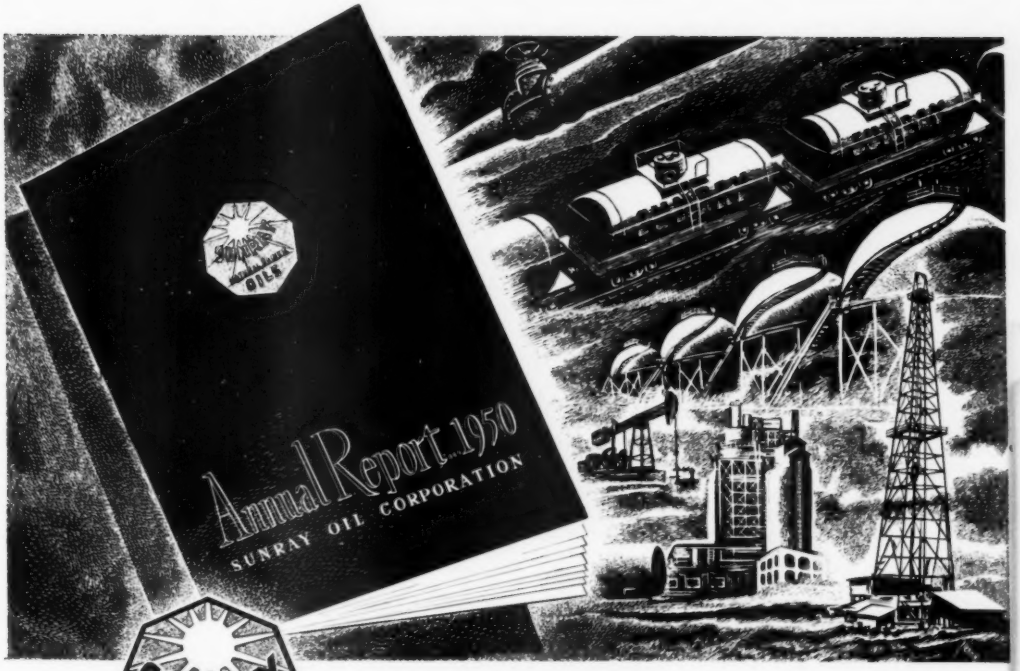
"Buy From Bovaird"

THE Bovaird SUPPLY COMPANY

GENERAL OFFICES
TULSA, OKLAHOMA

80 YEARS OF PROGRESS WITH THE OIL INDUSTRY

PETROLEUM . . . Essential to our Nation's Progress



SUNRAY
NATURAL POWER
OILS

In 1920, SUNRAY entered the oil business with limited resources, and a force of thirty employees. Today the Company has more than 2,000 employees.

The primary business of the Company is the discovery, development and production of oil and natural gas, the refining of gasolines, fuel oils, asphalts, etc., and the manufacturing of LPG products. The greater part of its oil producing activities are concentrated in the states of Arkansas, California, Illinois, Kansas, Louisiana, Mississippi, New Mexico, Oklahoma, Pennsylvania, Texas and Wyoming. SUNRAY and its associates have producing properties and much undeveloped acreage in Canada.

While SUNRAY has never chosen to set up a retail marketing division the familiar SUNRAY trademark is now seen on many oil storage tanks, tank cars and drilling rigs throughout the oil country. SUNRAY, in this comparatively short period of time, has become one of the large progressive independents in the producing, refining and liquefied gas divisions of the petroleum industry.

THIS IS OUR STORY . . . .

In a recent meeting of Sunray's Board of Directors, C. H. Wright, President, stated "The merger of the former Barnsdall Oil Company into Sunray Oil Corporation has been the most important step in the growth of this Company from the small beginning 30 years ago to its present size, with assets amounting to $276,000,000. The Company's gross income in 1950 was $94,000,000 — not including Barnsdall for the first 6 months."

After taxes and expenses, 1950 net profits of the Corporation exceeded $20,000,000—approximately double the earnings of the previous year. Approximately 45% of this amount was distributed as dividends on Preferred and Common Stocks — the rest was retained in the business for future growth.

The Sunray Financial Report tells the interesting story of the Corporation's development of its holdings. Its 3,237 producing wells account for more than 71,000 net barrels of crude oil and distillates daily. Its modern refining facilities processed 11,318,000 barrels against 9,617,000 throughput in 1949.

Many more interesting facts relative to Sunray Oil Corporation's widespread operations for 1950 are covered in the current Annual Report. If you will request a copy it will be promptly mailed to you.

An Aggressive Name in Oil . . . **SUNRAY OIL CORPORATION**

GENERAL OFFICES: FIRST NATIONAL BUILDING • TULSA, OKLAHOMA

For 1950 Sunray Annual Report giving financial information, write the Secretary, Sunray Oil Corp., 1812 First Nat'l Bldg., Tulsa 3, Okla.

Six Years before Spindletop-

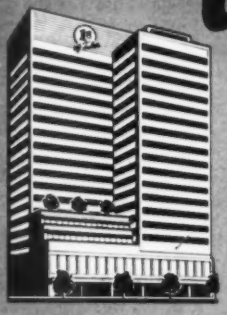
-Thinking Oil Men were

thinking-

1st

of Tulsa

-and Still Are!

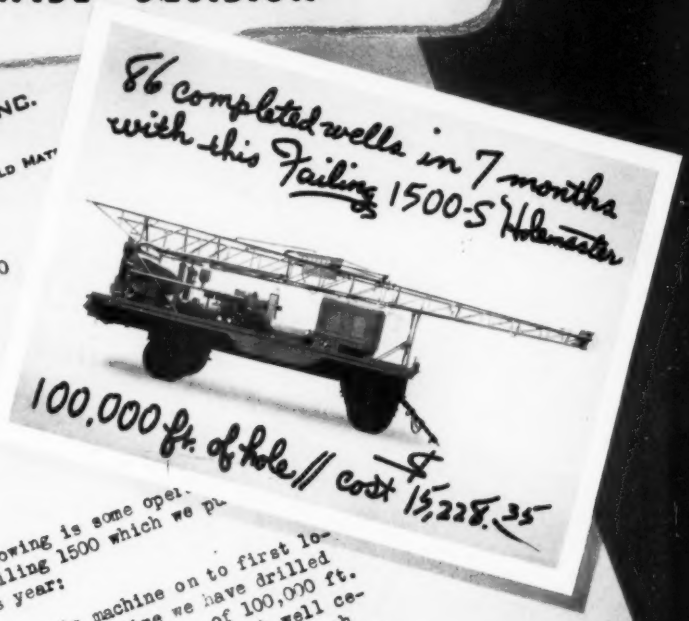


THE FIRST NATIONAL BANK
AND TRUST COMPANY OF TULSA
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION
...an Oil Bank Directed by Oil Men
in the Oil Capital of the World

"WE MADE A WISE DECISION"

COFFIELD & GUTHRIE, INC.
Producers of Crude Oil
DEALERS IN USED CASING, PIPE & OIL FIELD MATE
CORSICANA, TEXAS

November 10, 1950



George E. Failing Supply Co.
Enid , Oklahoma

Gentlemen:-

The following is some oper.
in connection with the Failing 1500 which we pu
from you in April of this year:

We moved this machine on to first lo-
cation April 20th. and since that time we have drilled
a total of 86 wells, with a total footage of 100,000 ft.
The time involved included running pipe in each well ce-
menting same, then go back in hole drill plug and wash
well clean. The total cost to us for the drilling of this
100,000 feet of hole was $15,228.35, distributed as follows:

Supplies	$ 2,718.73, this included
Wages	$11,343.00
Fuel	$ 1,166.62.

drilling bits.

While you may have records that are better
than the above, we are very proud of it and think we made a
wise decision when we decided to purchase the Failing rig for
our work on water flooding.

Very truly yours
Coffield & Guthrie Inc.
By W. S. Guthrie
W. S. Guthrie

DRILLING HAS COME A LONG WAY SINCE SPINDLETOP... AND SO HAS GEORGE FAILING, "FATHER" OF THE PORTABLE ROTARY DRILL.

Geo. E. Failing Supply Co.
"HOME OF THE HOLEMASTERS"
ENID, OKLAHOMA
U.S.A.

HOUSTON · MIDLAND · CASPER · HATTIESBURG · EDMONTON

WEST COAST AND MEXICO: JAY C. FAILING, ROOSEVELT BLDG., LOS ANGELES 14, CALIFORNIA
EXPORT MANAGER: GEO. P. GREGORY, JR., 30 ROCKEFELLER PLAZA, NEW YORK 20, NEW YORK

Let's make history in the future, too!
It is satisfying to look back on the tremendous strides made by the industry in the past 50 years. It is even more important, perhaps, to look ahead and apply past experience in plotting the course for the future.
The pride we take in Naylor's contribution to this progress is tempered by the realization of our still greater responsibility to the industry in the years ahead.
APPLICATIONS OF NAYLOR PIPE
Dewatering pipe. Gas and oil lines. Gas and oil gathering lines. Salt water disposal lines. Sludge lines. Surface casing (threaded). Vacuum lines. Syphon pipe. Tank gauge pipe. Tank swing pipe.
NAYLOR PIPE COMPANY
1232 E. 92nd St. · Chicago 19, Illinois
NEW YORK OFFICE
350 Madison Ave. · New York 17, N.Y.
Mid-Continent Supply Company, FORT WORTH, TEXAS, AND BRANCHES
Exclusive distributors in Mid-Continent and Gulf Coast Areas

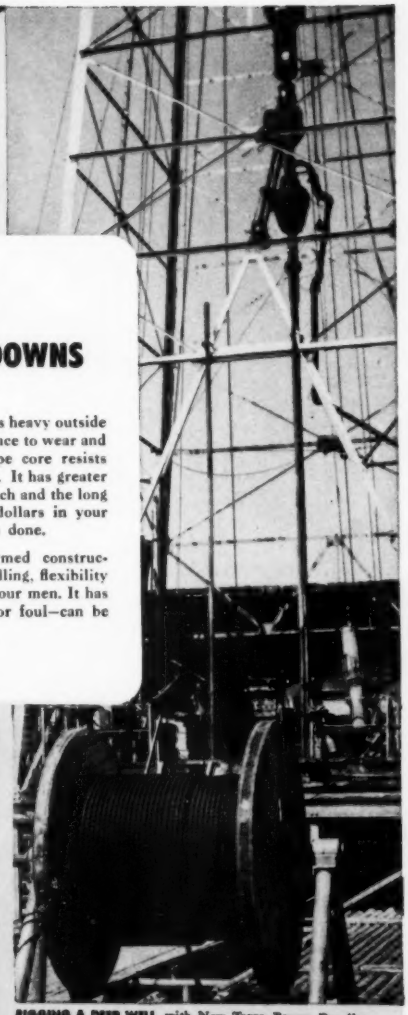
Judge it by the jobs it handles

Deep well gets rigged with Tiger Brand Line for FEWER SHUTDOWNS

WHAT does a day's loss of drilling time cost you? $1000 or more? Even the loss of a few hours runs into big money! That's why it's so important to choose the line that gives you the most ton-miles before a line shift is necessary. Many drilling contractors have discovered that this is TIGER BRAND Excellay Preformed 6 x 19 with Independent Wire Rope Core.

This TIGER BRAND Rope has demonstrated its superior performance on hundreds of wells. It has heavy outside wires for greater resistance to wear and abrasion. The wire rope core resists crushing on heavy loads. It has greater strength, minimum stretch and the long life that means more dollars in your pocket when the job is done.

TIGER BRAND Preformed construction gives you easy handling, flexibility and greater safety for your men. It has less tendency to kink or foul—can be run at higher speeds.



RIGGING A DEEP WELL with New TIGER BRAND Excellay Preformed Line with I.W.R.C. for more ton-miles and fewer shut-downs.

WATCH YOUR LUBRICATION. TIGER BRAND Ropes are thoroughly lubricated at the factory with Tiger Lube — a special lubricant that does not run in hot weather and still does a good job in cold weather. Use Tiger Lube for longer rope life.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

AMERICAN TIGER BRAND WIRE ROPE

USS *Excellay Preformed*

SEND THE COUPON FOR OUR HANDBOOK.

American Steel & Wire Company
Rockefeller Bldg., Dept. P-5
Cleveland, Ohio

Please send your handbook, "TIGER BRAND Wire Rope for Oil, Gas and Water Wells."

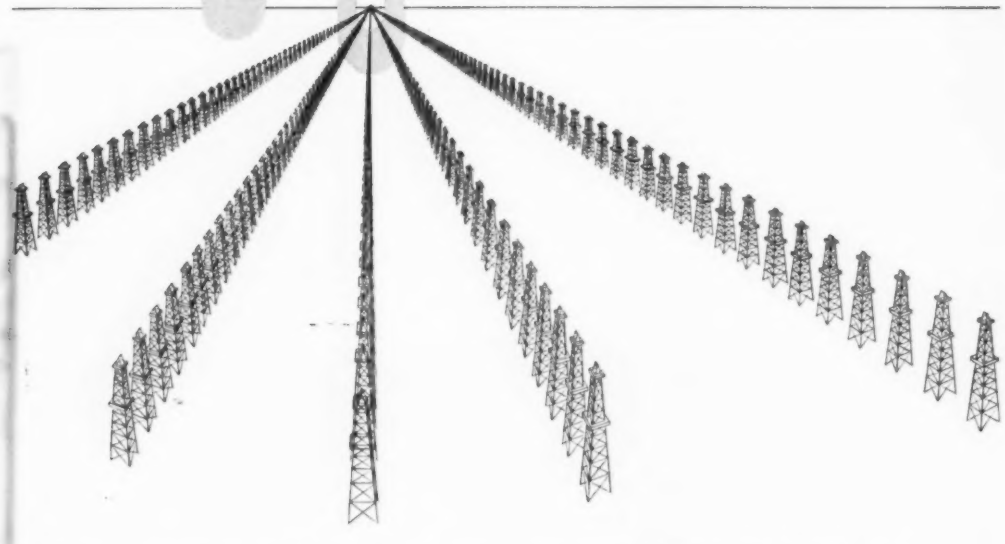
Name.....

Address.....

City..... State.....

UNITED STATES STEEL

1870 *is more than 3000 oil wells ago*



That's the year Atlantic was established. But we've grown to be a lot more than a collection of over 3000 producing oil wells! From the beginning, Atlantic pioneered in the true sense of that word. In the process of becoming integrated into a company producing, transporting, manufacturing and marketing petroleum and its products—Atlantic stepped from "first" to "first" in the search for new products, new quality. Some of those steps:

First to develop high pressure gas injection techniques for maximum oil field returns.

First use of "Tower" still.

First application of the mass spectrometer to gasoline production.

First combat aviation gasoline (World War I).

First to use microwave radio release communication system for pipe lines.

First to use atomic energy in petroleum research.

Out of such pioneering research came Atlantic's great production of Petroleum Chemicals—ULTRAWET synthetic detergents, Sulphonates, Olefins—sold throughout the United States and in Europe. Out of such research, too, came Atlantic's revolutionary new catalytic reforming process designed to accomplish a better yield of better gasoline.

The Atlantic Refining Company's research moves constantly ahead to benefit all of us. We look back on 81 years of a proud past. We look ahead to a well-planned, active future.

ATLANTIC

If It's All-Cameron It's All Right!

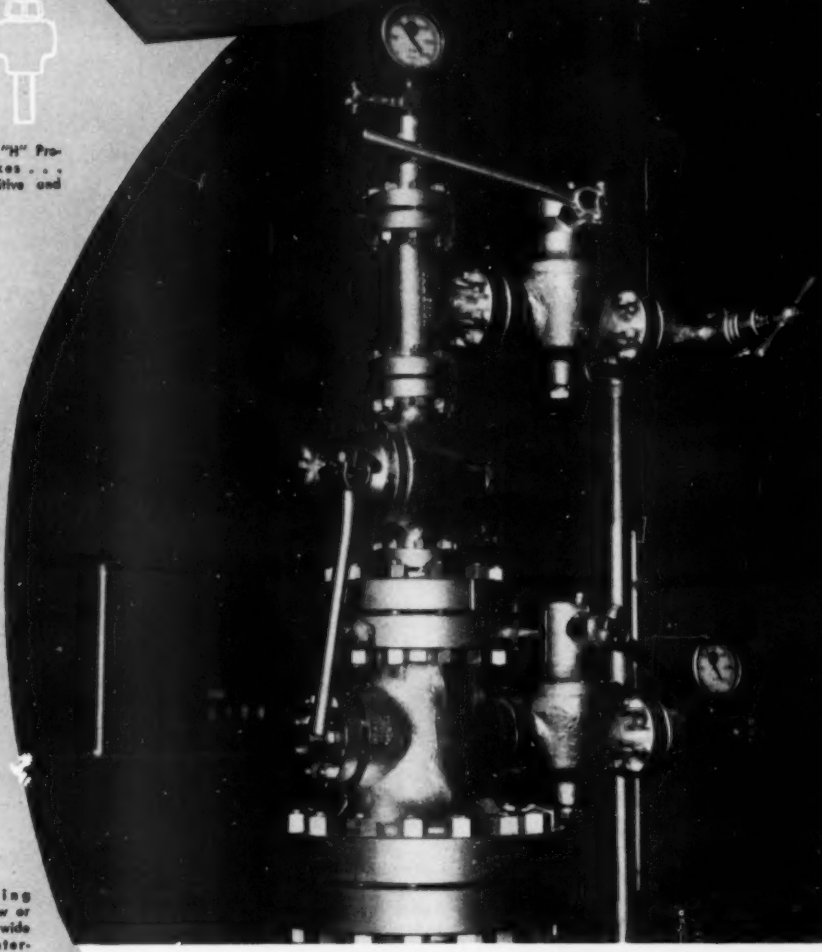
Cameron Type "H" Production Chokes . . . convertible positive and adjustable.

Cameron Non-Lubricated Lift Plug Valves . . . . combining the best features of gate and plug valves with exclusive Cameron innovations.

Cameron Fittings . . . tees, crosses, adaptors, spools—everything required to round out your tree.

Cameron Tubing Heads, lock screw or ram type, with a wide selection of interchangeable hangers.

Cameron Casing Heads and Spools . . . with proven hangers and seals to best meet your requirements.



Instead of assembling your Christmas tree from various manufacturers' products, and thus dividing the responsibility for its proper functioning and servicing, **why not go all the way with Cameron?** Since the introduction of the Non-Lubricated Lift Plug Valve, which has enabled Cameron to offer the industry Christmas trees assembled entirely from Cameron products, many operators, sensing the advantage of this undivided responsibility, have standardized on the **ALL-CAMERON** tree.

CAMERON IRON WORKS, INC.

P. O. BOX 1212 • HOUSTON, TEXAS

EXPORT: 74 Trinity Place, New York

WAREHOUSE STOCKS ARE CARRIED AT:

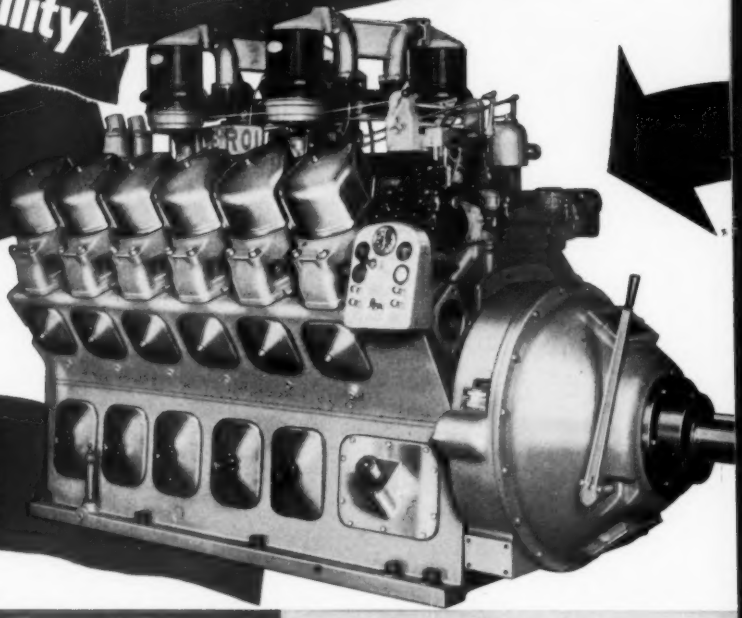
Corpus Christi, Odessa, and Snyder, Texas; Long Beach, California, and Casper, Wyoming.

Greater Accessibility

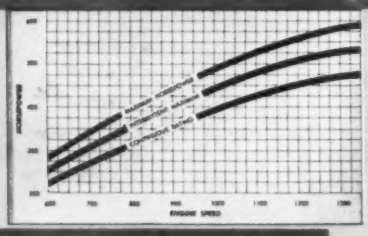
Greater Speed Range

Compactness

More Power

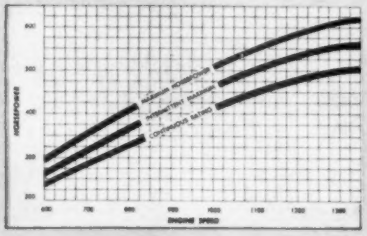


More Power—Wider Speed Range

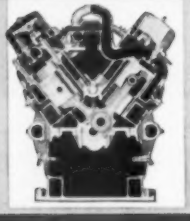


Gasoline or natural gas

Butane

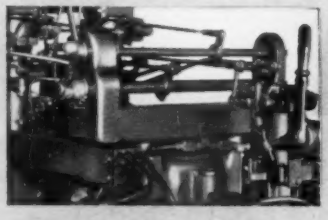


Faster Acceleration



Take a good look at the L-3460's V-12 design. Note the lightweight aluminum pistons, and short-radius rotating parts. You can see why the L-3460 gives you lightning-fast response to load demand.

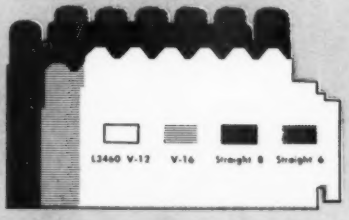
This governor will interest you, too. It is semi-hydraulic and responds instantly to load changes, whatever they may be.



More Compact—Easy Installation

LE ROI

Just compare the L-3460 with other designs of equal displacement. Remember too, the L-3460 complete with radiator, weighs only 12,200 lbs. That's why the L-3460 saves you installation time and money — is easier to move around.



LeRoi 600hp L-3460

EVERYTHING YOU ASKED FOR IN AN ENGINE

The L-3460, with its 600 maximum horsepower, is designed and built to meet oil-field demands for more power.

Its fast acceleration, wide speed range, lugging power at slow speeds, and compactness make it outstanding for drill-rig applications.

Its dependability and economy under continuous load, its space-saving size for easy installation, and its accessibility that simplifies maintenance give you an unbeatable power unit for any type of oil-field application — drilling, pipeline, generator drives, etc.

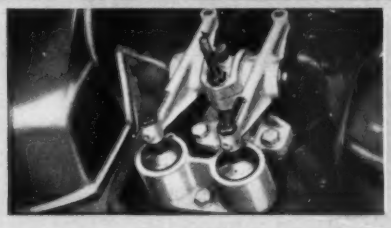
Here, in the L-3460, you have oil-field power at its best — wide speed range from 600 to 1350 rpm, and horsepowers from 350 to 600. If you want to keep a tight rein on costs, nothing but the best will do. So let the L-3460 go to work for you now — it's everything you asked for in an engine. For further information, see your Le Roi distributor — or write for our new bulletin E-3.

LE ROI COMPANY

MILWAUKEE 14, WISCONSIN

Plants: Milwaukee — Cleveland — Greenwich, Ohio • Oilfield Headquarters: Tulsa, Oklahoma

Easier Maintenance—Lower Costs



Valve-in-head design lets one man remove cylinder heads without disturbing manifold, carburetor, or controls.

One-piece crankcase and cylinder construction provides unusual rigidity — prevents misalignment. The L-3460 is built to take the punishment of oil-field handling.

Replaceable cylinder sleeves do away with costly reboring and expensive oversize parts.

P-188

Le Roi's 23rd year in the Petroleum Industry

Back in 1928, Le Roi pioneered the application of internal combustion engines to drilling rigs. In these early days the problem was extremely complicated—required the use of jackshafts, reduction gears, and reverse mechanisms. Another difficulty arose from the fact that the engine had to be adapted to existing draw works which, of course, were designed and built for steam-engine operation.

Le Roi surmounted these obstacles by designing internal combustion engines that duplicated the performance heretofore achieved with steam controls — without the need for countershaft, belts, or other apparatus. These new Le Roi engines had other advantages, too. They were smaller in size, lighter in weight, and had a wide speed range.

The popularity of Le Roi engines for drilling increased rapidly. Not only did they duplicate steam operation, but they also contributed a great deal more: They were adaptable to any type of drilling, reduced transportation costs, simplified rigging, saved tremendously on fuel and water, and increased drilling speeds.

Because of this pioneering and the "know-how" we have gained, Le Roi engine design has always kept pace with the horsepower, weight, and dependability needs of the petroleum industry — by continuous improvement and the addition of new models to the line. That is why Le Roi engines are universally accepted today by the industry — not only for drilling, but also for oil-well pumping and pipeline service.

1901 ..... **"Spindletop"** meant oil,
"Cabot" meant carbon black.

1951 ..... **"Spindletop"** stands as the symbol of oil become an industry.
"Cabot" continues to mean carbon black . . . and more, too.

1882 .....Since 1882 Cabot has drilled wells, laid pipe, built plants, moved plants, rebuilt plants, built more new plants, sat up nights and studied hard to stay at the head of the parade.

Though now the world's largest producer of carbon blacks, Cabot is equally proud of its solid reputation in the oil industry as a neighbor, producing member, and manufacturer of high quality oil well pumping units and surface equipment.

GODFREY L. CABOT, INC.

77 FRANKLIN STREET, BOSTON 10, MASS.

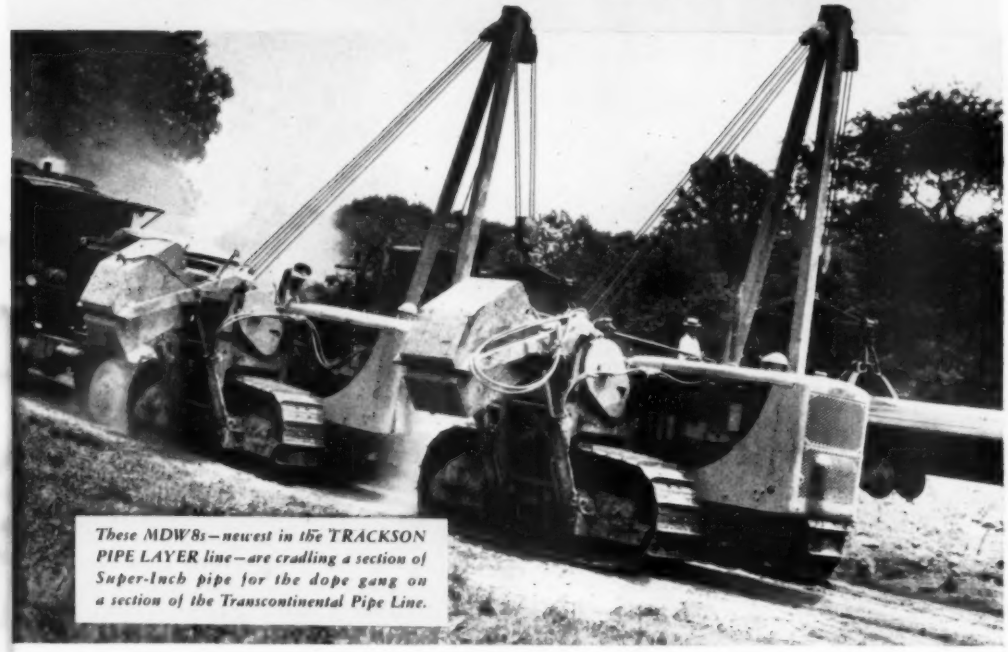
PACEMAKER
Today and Tomorrow

Behind the Flying Red Horse in the producing oil fields of the Southwest are Magnolia's production men armed with knowledge of how to get the most oil from hidden reservoirs far beneath the surface of the earth. After completion of a producing well these men set their sights for the greatest ultimate recovery of crude in the most economical manner . . . They form a team with engineers and researchers to study flow schedules at the most efficient rates . . . Underground reservoir pressures are maintained as long as possible in a never-ending program of conservation . . . The most modern pumping equipment comes in to lift the oil to the surface on efficient pumping schedules . . . Old fields are made to increase their yields by successful application of scientific secondary recovery methods . . . This teamwork between the production man, the engineer and the researcher means more oil over a period of years and a longer life expectancy of the field—more conservation of our natural resources . . . and teamwork between Magnolia's Exploration, Producing, Transportation, Refining and Marketing Divisions make the Flying Red Horse a pacemaker today and tomorrow.

MAGNOLIA PETROLEUM COMPANY

ONE OF THE FLYING RED HORSE COMPANIES

TRACKSON
CHANGED THE PIPE LINE STORY!



These MDW8s—newest in the TRACKSON PIPE LAYER line—are cradling a section of Super-Inch pipe for the dope gang on a section of the Transcontinental Pipe Line.

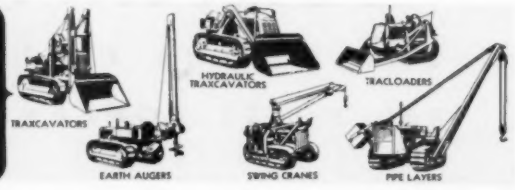
SINCE "Old Spindletop" blew its top in 1901, the oil and natural gas industry has made tremendous progress. With the laying of the first line in 1908, Pipe Lining became one of the important segments of the industry . . . however, it was not until the middle twenties that the Pipe Line industry really hit its stride.

A new chapter was added to the story in 1927 when the first TRACKSON TRACTOR EQUIPMENT was put out on Pipe Line construction . . . rapid mechanization followed. Due to top performance, TRACKSON machines are the recognized leaders in their fields . . . preferred for every Pipe Line job.

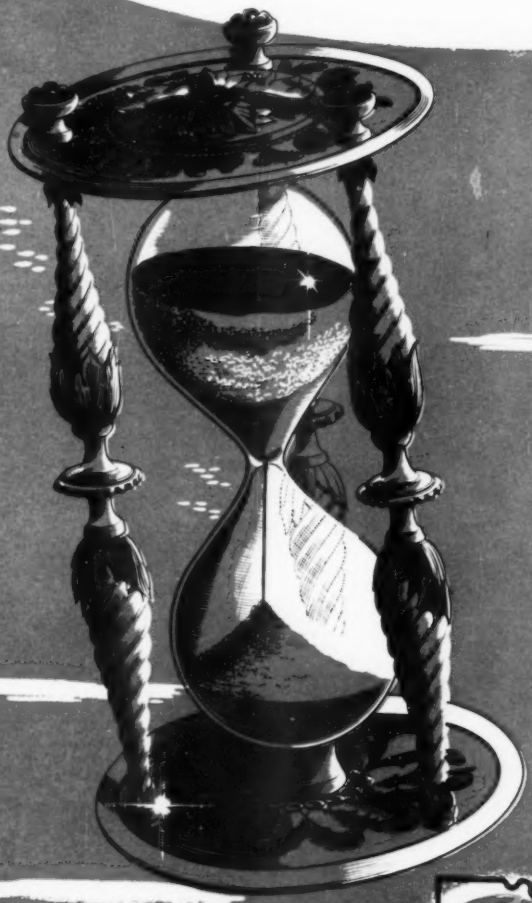
TRACKSON PIPE LAYERS, ANGLE-FILLERS, TRAXCAVATORS, EARTH AUGERS and SWING CRANES, with their matching "Caterpillar" Diesel Tractor teammates, are playing an important part in the Pipe Line story . . . whether Little-Inch, Big-Inch or Super-Inch . . . with money-making, time-saving efficiency.

These modern tools can change *your* Pipe Line job to one with greater profits. Ask your nearby TRACKSON-"Caterpillar" Dealer for complete information on the models that fit your contract . . . or write TRACKSON COMPANY, Dept. OG-51, Milwaukee 1, Wisconsin.

TRACKSON
TRACTOR EQUIPMENT



the Golden Sands of Time



Just as the Golden Sands of time create the valuable Petroleum deposits in Mother Earth, so time matures and shapes a company's destiny in the field it serves. Young in itself, Dresser Industries and its operating companies consider time, translated into terms of Experience, as one of their greatest Assets.

DRESSER INDUSTRIES, INC.

ATLANTIC BUILDING . DALLAS, TEXAS

471 Years Young

in Oil and Gas Industry Experience

The established leadership of each member within its own specialized field is enhanced through the unique functioning of Dresser Industries, Inc. The combining of nearly five centuries of experience, pooling of ideas, mutual exchange of research and techniques of manufacture, has produced for the oil and gas industry essential and efficient equipment, from well to consumer, which has won world-wide acceptance.

	Founded
BOVAIRD & SEYFANG MANUFACTURING COMPANY *Bradford, Pa.*	1891
CLARK BROS. CO., INC. *Olean, N. Y.*	1880
DRESSER MANUFACTURING DIVISION *Bradford, Pa.*	1880
DRESSER MANUFACTURING COMPANY, LIMITED *Toronto, Ont., Canada*	1931
IDECO *Dallas and Beaumont, Texas; Columbus and Delaware, Ohio; Torrance, Calif.*	1920
KOBE *Huntington Park, Calif.*	1923
MAGNET COVE BARIUM CORPORATION *Houston, Texas; Malvern, Arkansas*	1940
PACIFIC PUMPS, INC. *Huntington Park, Calif.*	1923
ROOTS-CONNERSVILLE BLOWER CORPORATION *Connersville, Indiana*	1854
SECURITY ENGINEERING CO., INC. *Whittier, Calif.*	1931
THE STACEY BROS. GAS CONSTRUCTION COMPANY *Cincinnati, Ohio*	1915

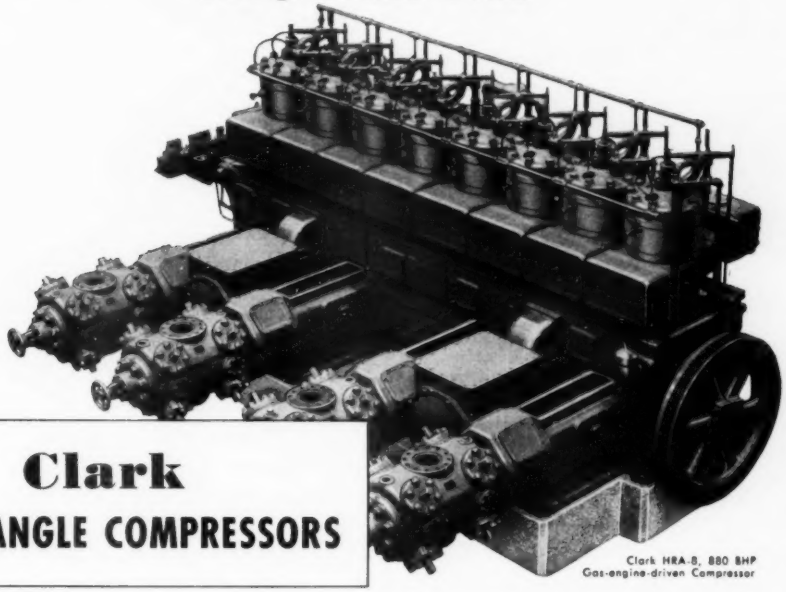
Parent Corporation

DRESSER INDUSTRIES, INC.

ATLANTIC BUILDING . . . DALLAS, TEXAS

Leadership

THE WORLD OVER



Clark HRA-8, 880 BHP
Gas-engine-driven Compressor

Clark
RIGHT ANGLE COMPRESSORS

● 2,500,000 BHP! That's the volume of Clark Right Angle Type Compressors placed into world-wide service since the first unit was introduced to the petroleum industry in 1936.

And while markets for this exceptionally rugged compressor are forever broadening, a great proportion of this 15-year volume has been built up by repeat orders . . . from major oil producers, refiners, gas transmission pipelines, chemical plants and other industrial users who have utilized additional units either to improve their present facilities or to serve new installations. What could be more convincing of a product's satisfactory performance and acceptance?

Built in sizes ranging from 150 to 2500 BHP, Clark HBA, HRA and MA Compressors, through continual engineering improvements, are today setting new standards of efficiency and performance.

By reputation and by the record, you will be served best by Clark Proved Compressors, available in diversified designs to meet your requirements.

MIDGET ANGLE • RIGHT ANGLE • BIG ANGLE
ELECTRIC-DRIVEN • CENTRIFUGAL

CLARK BROS. CO., INC.
OLEAN, N. Y.

One Of The Dresser Industries

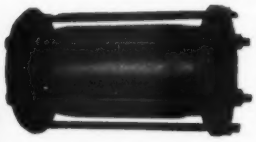
SEE the difference in

CLARK®
COMPRESSORS

New York • Tulsa • Houston • Chicago • Boston • Washington • Los Angeles • Birmingham • Detroit • Salt Lake City • San Francisco
London • Paris • Varese, Italy • Buenos Aires • Caracas, Venezuela • Lima, Peru • Bogota, Colombia • New Delhi, India

Convenient!

you can buy these products through these Companies



DRESSER LONG SLEEVES

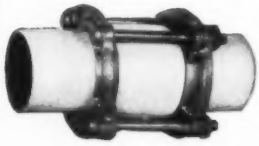
(Style 40) simplify pipe joining. Span gaps between pipe ends. No threading, exact fitting or aligning. Ideal joint at wells, separators, pumps, engines and tanks.

DRESSER COUPLINGS

(Style 38) speed laying of field, gathering and transmission lines; save time on hookups; absorb vibration at pumps, engines and compressors. 100% salvageable in relocating temporary lines.

DRESSER SPLIT REPAIR CLAMPS

(Style 798) for quick repair of pitholes and longitudinal splits in pipe. Furnished with either one or two shells—an inexpensive "bandage" which saves cutting out short sections of damaged pipe.



DRESSER COLLAR CLAMPS

(Style 4,41) stop leaks through threads of screw collars, without service interruption. Band Clamps (Style 77B), Porous Weld Clamps (Style 55), and other pipe repair devices also available.

(Partial List)

Alamo Iron Works
American Pipe & Supply Co.
American Supply Co.
Arrow Supply Co., Inc.
Banks-Miller Supply Co.
Bethlehem Supply Co.
F. W. Black
Bluefield Supply Co.
Bovaird & Co.
Bovaird & Seyfang Mfg. Co.
The Bovaird Supply Co.
Bradford Supply Co.
Briggs-Weaver Machinery Co.
Brown-Strauss Corp.
Buckeye Supply Co.
The Cameron & Barkley Co.
Capital City Supply Co.
Cen-Tex Supply Co.
Clowe & Cowan, Inc.
Continental Supply Co.
Crane Co.
Dunigan Tool & Supply Co., Inc.
Federal Oil Field Supply Co.
Federal Supply & Machine Co., Inc.
Franklin Supply Co.
French Tool & Supply Co.
Frick & Lindsay Company
General Oil Field Supply Co., Inc.
Greenhead Supply Co.
Grinnell Co.
Houston Oil Field Material Co., Inc.
Howard Supply Co.
Industrial Supply Co.
International Derrick & Equipment Co.
Iverson Supply Co.
Jarecki Manufacturing Co.
Jones & Laughlin Supply Co.
Lloyd-Smith Co.
Louisiana Supply Co.
The McJunkin Supply Co., Inc.
Mid-Continent Supply Co.
Midland Supply Co., Inc.
Morrison Supply Co.
Mountain Iron & Supply Co.
Murray-Brooks Hardware Co., Ltd.
Murray Tool & Supply Co.
The National Supply Co.
Norvell-Wilder Supply Co.
Oil Well Supply Co.
Parkersburg Rig & Reel Co.
The Peerless Supply Co., Inc.
Pelican Well Tool & Supply Co.
Producers Supply & Tool Co.
Republic Supply Co.
Republic Supply Co. of California
Rodman Supply Co.
Standard Supply & Hardware Co., Inc.
Superior Iron Works & Supply Co., Inc.
United Supply & Mfg. Co.
Weaks Supply Co., Ltd.
Well Machinery & Supply Co., Inc.
Western Supply Co.
Wilson Supply Co.

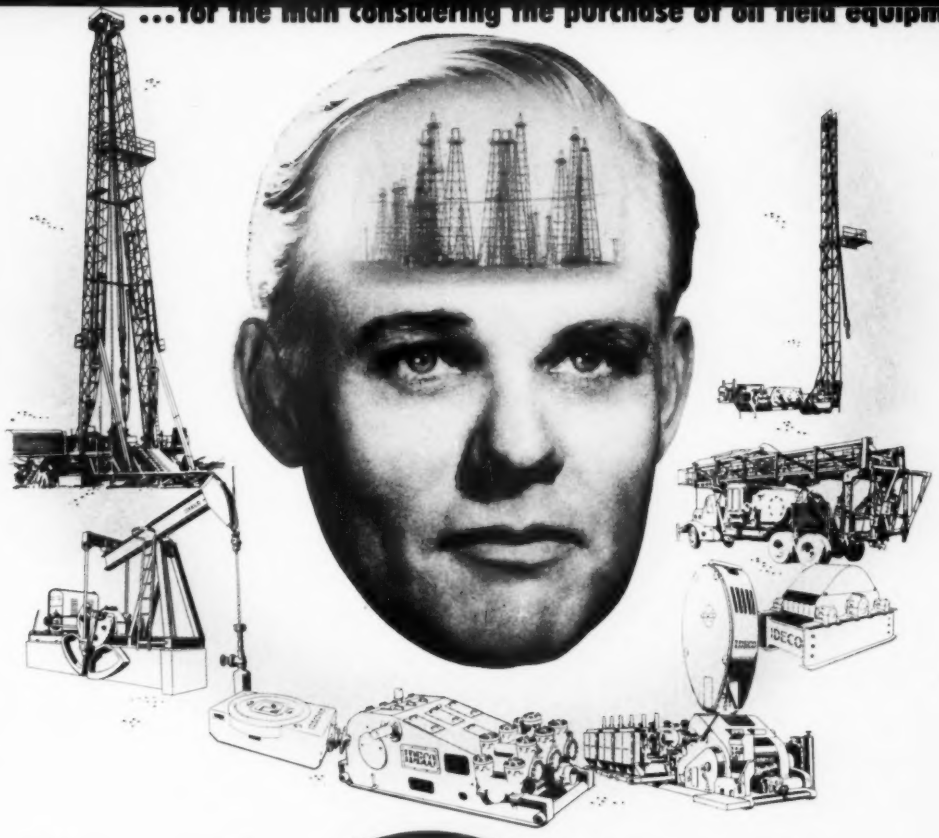
Always within "hollering distance"

at your nearest oil field supply store or our Houston Warehouse, Dresser products save installation time and give you *reliable* connections and repairs.

DRESSER COUPLINGS and Repair Products

Dresser Manufacturing Division (One of the Dresser Industries), 59 Fisher Ave., Bradford, Pa. • Houston Office & Warehouse: 1121 Rothwell Street, Houston, Texas. • Sales Offices: New York, Chicago, Houston, San Francisco.

...for the man considering the purchase of oil field equipment...



This emblem IDECO *adds much to the value . . . nothing to the cost!*

IDECO leads in the development of modern oilfield equipment, through advanced engineering. This forward-thinking policy has been responsible for . . .

1. **the adaptation of torque converters to full rig applications, including pump drives;**
2. **the application of air clutches throughout the complete rig;**
3. **full air controls, extended even to pump drives;**
4. **the introduction of fully mobile equipment such as the IDECO Rambler Rig;**
5. **the development of Kwik-Lift Masts—proved by 10 years of service;**
6. **development of "Fabriform" Sheaves with rolled-forged, flame hardened rims for crown and traveling blocks;**
7. **continued development of IDECO pumping units to meet the changing needs of industry and A.P.I. specifications . . .**

. . . And now, 8 ***Ideco has revolutionized the portable oilfield mast business with the development of the Full View Mast!***

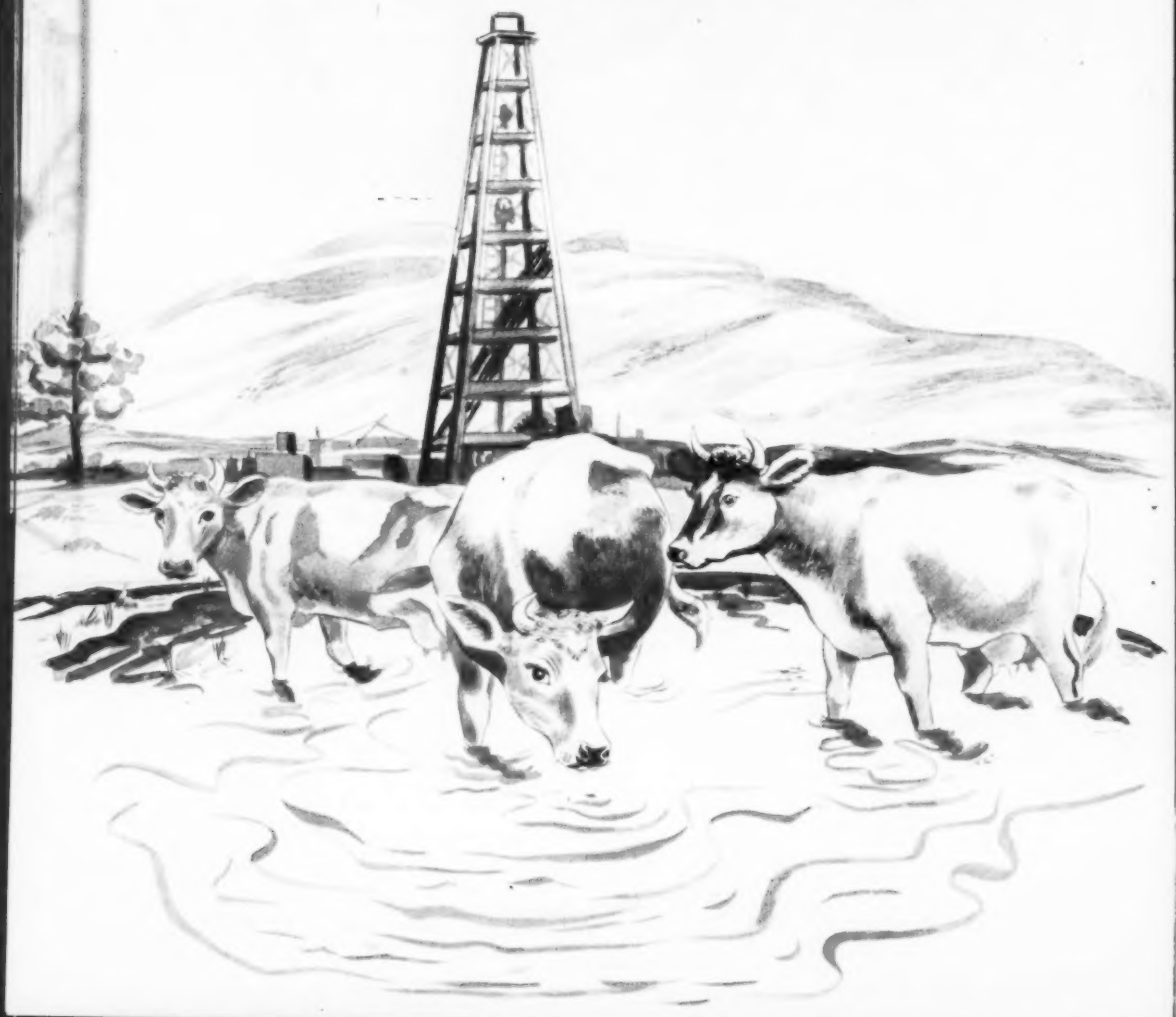
IDECO—ONE OF THE DRESSER INDUSTRIES

HEADQUARTERS: Export, Machinery, and Stores Divisions—Dallas, Texas.
PLANTS: Beaumont, Texas; Columbus and Delaware, Ohio; Torrance, California.
EXPORT OFFICES: Dallas, Texas; New York City; Torrance, California. Argentina—Buenos Aires; Brazil—Rio de Janeiro; Colombia—Barranquilla; England—London; France, Paris; Italy—Pignone Dresser Co.—Florence, Milan, Rome; Turkey—Ankara, Istanbul; Venezuela—Caracas, Maracaibo.

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

Since cows mixed mud for

DRILLING MUD A SCIENCE



the Spindletop discovery well

HAS BECOME ALL ITS OWN

History records . . . and many an old-timer is still around to confirm it . . . that mud used in the Spindletop well was actually siphoned from a near-by mud hole, agitated by cows wallowing and trampling through the mire.

Through chemistry, modern drilling muds that play such a vital role in today's deep, high pressure oil well have evolved into a complex, specialized science all their own. The carefully compounded and controlled drilling muds used in deep Gulf Coast wells today, for example, are a far cry from the earth-and-water muds used in early discovery wells that established the Gulf Coast region as one of the world's most prolific oil producing areas.

But with the steadily increasing demands for more and more drilling muds and chemicals, the question of future supplies became an acute problem. Then, in 1941, the producers of Magcobar developed a process for beneficiating ore from a vast deposit at Magnet Cove, Arkansas, and made available many million of tons of the world's finest mud weight for oil well drilling at the low . . . but fair and reasonable . . . price of $22.00 per ton in Gulf Coast fields.

During the past decade, the solutions to many of the oil industry's specialized drilling mud problems have been found by Magcobar chemists. Extensive research laboratory facilities are maintained to support Magcobar field service engineers in developing better muds to do the job and to lower drilling costs.

So, many years after cows mixed mud for the Spindletop discovery well, another new era began in drilling mud history . . . the era of Magcobar's abundant supply of highest quality products, good service and fair and reasonable mud prices. Look for the Magcobar sign when you need mud. More than 300 Magcobar dealers keep mud stocks available night and day.

MAGNET COVE BARIUM CORPORATION

MALVERN, ARKANSAS — HOUSTON, TEXAS

ONE OF THE DRESSER INDUSTRIES

Magcobar

MAGCOBAR • MAGCOGEL • HIGH YIELD • MAGCO-FIBER • XACT CLAY • FIBER SEAL • SALT GEL • MAGCO-PHOS • RED OX • MAGCO-MICA • TANNATHIN JEL-OIL MUD • JEL-OIL "E" • "E" CONCENTRATE • NOHEEV • SEAL FLAKES • MY-LO-JEL • DRISCOSE • MY-LO-JEL PRESERVATIVE • QUEBRACHO • CHEMICALS

Keep your eye on V·P·I WHEN SELECTING BLOWERS

CENTRIFUGAL

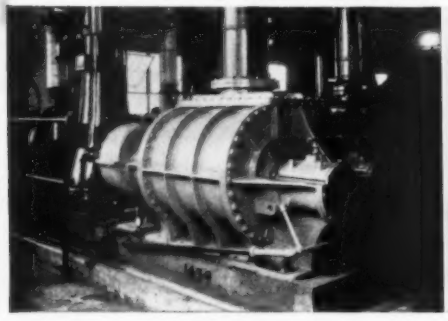
Type OI Centrifugal Blower in southwestern refinery. Capacity 13,000 cfm.

You can't afford to risk shutdowns today because of unsatisfactory or inadequate equipment performance. To keep production moving at the required fast pace, calls for blowers or gas pumps that continuously deliver positive Volume at required Pressure—and at Low power costs to reduce operating expense.

You get these 3 essentials from R-C Blowers and Gas Pumps. Whether your needs call for Centrifugal or Rotary Positive units, we can match them from our exclusive *dual-ability line*. With capacities from 5 cfm to 100,000 cfm, you can usually find R-C units that closely fit your demands, with resultant savings in time, cost, space, weight and power.

From an experience of almost a century of blower building, our engineers will gladly make suggestions of the right R-C equipment to move or measure gas and air to keep production going.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Texas Avenue, Connersville, Indiana



ROTARY

Rotary Positive Gas Pump for handling refinery gas. Capacity 3,100 cfm.

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

BLUEPRINT FOR DRESSER INDUSTRIES GROWTH...

Industrial growth can and should be blueprinted and engineered in the same manner as any technical project. A carefully designed long-range program becomes the framework upon which to build an integrated and successful enterprise. Economic and political markers along the way aid in the projection of these designs for expansion. Although geared to the present, such plans must necessarily look to the future and be flexible enough for timely readjustment to conditions in a world of changing economic and political trends.

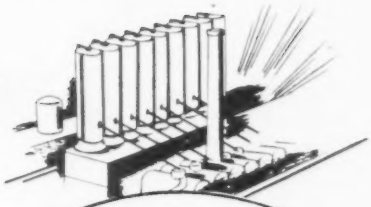
Dresser Industries is a particularly outstanding unification of the industrial facilities, talents and products of ten related companies joined together into an integrated whole. Each subsidiary company benefits from the long-range administrative counselling and planning of Dresser, yet retains in its regular operations its own flexibility and independence. Each company is responsible for meeting and overcoming competition and initiating its own research and product development.

These companies own twelve modernized plants in eight states. Their facilities, located on a total of 158 acres of land, have a combined floor space of more than 1.7 million square feet and a total personnel of 6,265. Equipment produced by these companies serves the drilling, producing, transportation and refining divisions of the great oil and gas industry. This is in keeping with the Dresser policy of manufacturing related products and equipment through the combined facilities and cooperation of its member companies. On a growing scale, products of the Dresser companies are finding wide acceptance in other industries.

As in World War II, Dresser Industries will be called upon to develop and supply defense products to the Armed Forces. In this respect, the result of Dresser's long-range, carefully engineered growth will be especially apparent. Singly or as a group, these companies are well prepared for the enlarged defense program that all industry faces today.

Steady Growth Since 1913

A dozen years after Spindletop, the first Mid-Continent Refinery was opened — a battery of seven crude stills, two batch agitators and an office in West Tulsa.



Today

One of the World's Largest Most Modern Refineries!

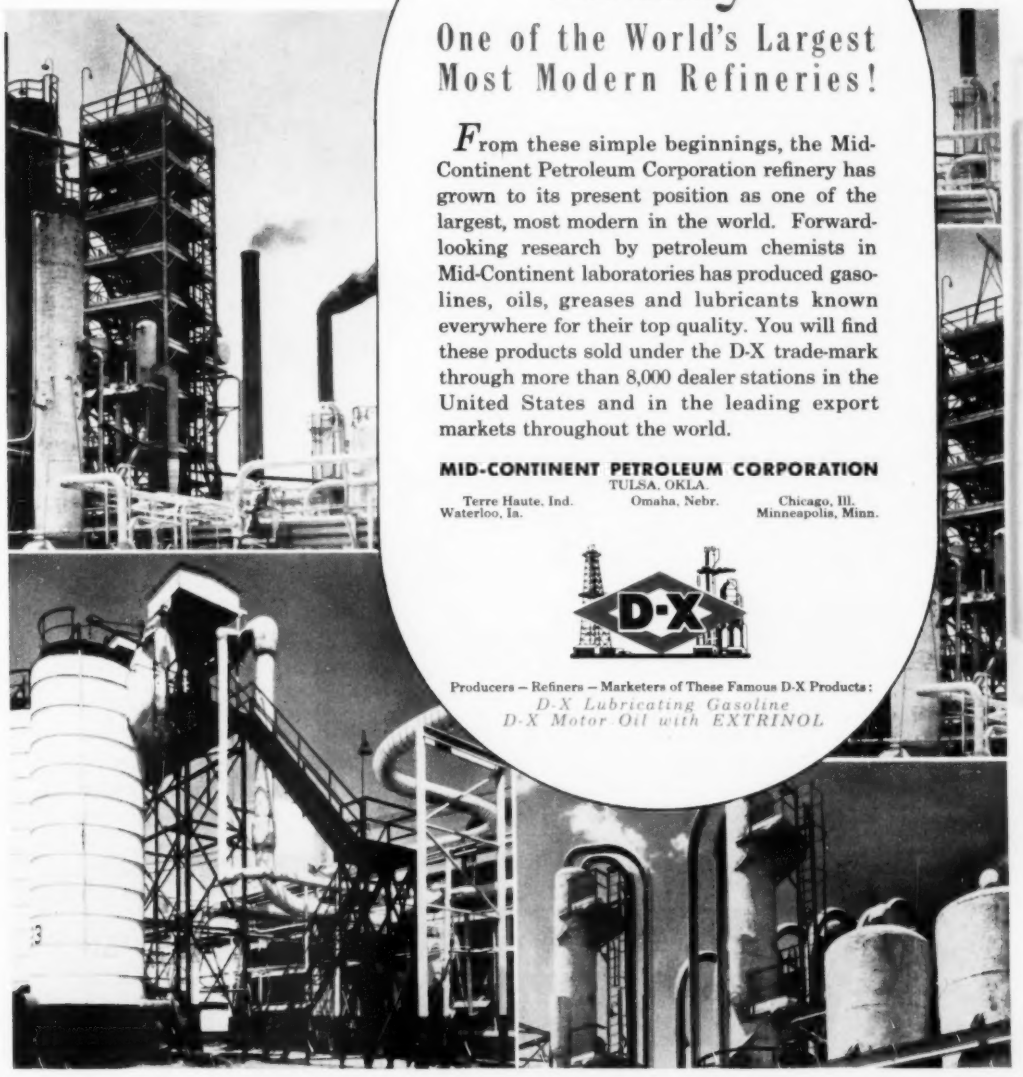
From these simple beginnings, the Mid-Continent Petroleum Corporation refinery has grown to its present position as one of the largest, most modern in the world. Forward-looking research by petroleum chemists in Mid-Continent laboratories has produced gasolines, oils, greases and lubricants known everywhere for their top quality. You will find these products sold under the D-X trade-mark through more than 8,000 dealer stations in the United States and in the leading export markets throughout the world.

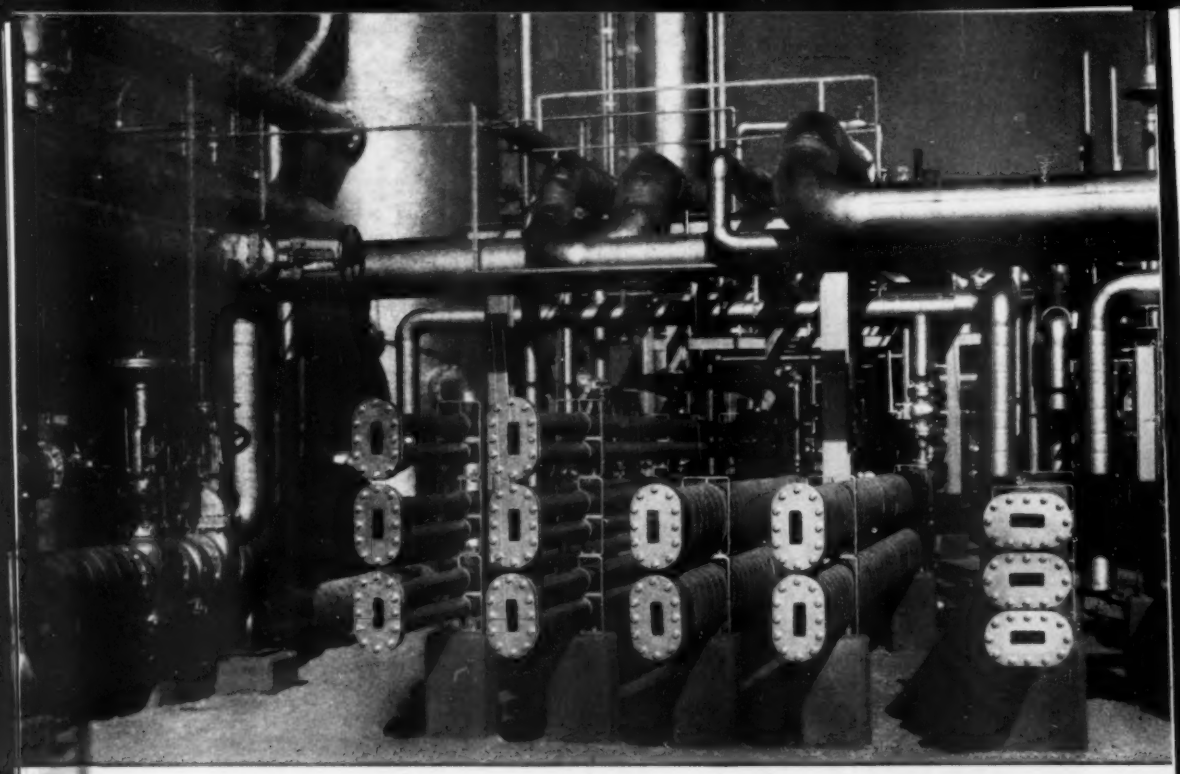
MID-CONTINENT PETROLEUM CORPORATION
TULSA, OKLA.

Terre Haute, Ind. · Omaha, Nebr. · Chicago, Ill.
Waterloo, Ia. · Minneapolis, Minn.

D-X

Producers — Refiners — Marketers of These Famous D-X Products:
D-X Lubricating Gasoline
D-X Motor Oil with EXTRINOL





use **BROWN FINTUBE**

Sectional Hairpin

HEAT EXCHANGERS *as*

- HEATERS
- COOLERS
- HEAT EXCHANGERS
- CONDENSERS
- GAS COOLERS
- REBOILERS
- FUEL OIL HEATERS
- LUBE OIL HEATERS AND COOLERS
- JACKET WATER COOLERS
- QUENCH OIL COOLERS
- COMPRESSOR INNER AND AFTER COOLERS

● These exchangers combine the repeatedly demonstrated advantages of Brown's exclusive integral "one-piece" fintubes that assure high heat transfer efficiency; and Brown's ring joint head end seal that is easily dissembled for cleaning, and reassembles tightly, preventing leakage. Furnished with fintubes of mild steel, stainless steel, monel, inconel, aluminum, admiralty or other non-ferrous metals to suit any requirement. Widely used — and highly endorsed by engineers, operators and maintenance men everywhere.

Write for Bulletin No. 481. It gives full details.

THE BROWN FINTUBE CO.
ELYRIA, OHIO

SECTIONAL
HAIRPIN
HEAT EXCHANGERS

After 31 Years...

STILL THE INDUSTRY'S MOST SUCCESSFUL FISHING TOOL

INTRODUCED IN 1920

UNDER PATENT NO. 1,344,437 MAR. 23, 1920

This is a picture of the first "HE" Reversing Tool manufactured, shown in use on Blue Ridge Production Company's well No. 2, at Blue Ridge. Second from the left is Mr. Porter, head driller on the well, and next to him, wearing a "boiled shirt," is Mr. Edwards, inventor of the "HE" Reversing Tool.

IMPROVED IN 1927

UNDER PATENT NO. 1,627,842 MAY 10, 1927

NOW... IMPROVED AGAIN!

UNDER PATENT NO. 2,462,478 FEB. 22, 1949

Since the "HE" Reversing Tool was introduced in 1920, improvements have been incorporated regularly in this dependable tool that takes the place, and does the job, of a full string of left-hand drill pipe. Now, it has been improved again . . . to provide a reversing tool with a large enough opening so that a string shot can be run through the tools and thereby make back-off at specified depth possible. Yes, after 31 years, "HE" Reversing Tools are still the industry's most successful fishing tools. Available for your convenience at: S. R. BOWEN FISHING TOOL CO., Santa Fe Springs, Bakersfield, Ventura, Avenal, California, and Casper, Wyoming. — M & B FISHING TOOL CO., Odessa, Snyder, Texas — HUDSON & JACKSON, Corpus Christi, Texas.

OIL WELL TOOLS · HOUSTON ENGINEERS INC. · HE

HOUSTON ENGINEERS, INC.

P. O. BOX 567 — 1412 ENNIS STREET — HOUSTON, TEXAS

Service Stores: Houston, Texas; New Iberia and Houma, Louisiana

COMPLETE FISHING TOOL SERVICE AT ALL "HE" STORE POINTS

A *Salute* to

THE OIL AND GAS JOURNAL

in rounding out five decades of
outstanding journalistic and editorial
contribution to oil men and their work.
Congratulations on a fine record
and good wishes for increasing success during
the next half-century of service
to the oil industry.

STANDARD OIL COMPANY
(INDIANA)

1907

"the pump preferred by experienced drillers who want results"

OIL INVESTORS' JOURNAL

January 3, 1907

The Gardner Slush Pump

is not an experiment but a substantial verity. It has proven its value by successfully withstanding the hard, continuous service in the oil fields, and for that reason is the Pump preferred by the experienced drillers who want results.

The Gardner if full of good features, it is the

rate chambers, easily accessible for repairs, easily

discharge valves, air chamber without

are fitted with rolled bearings without

renewal of the rollers

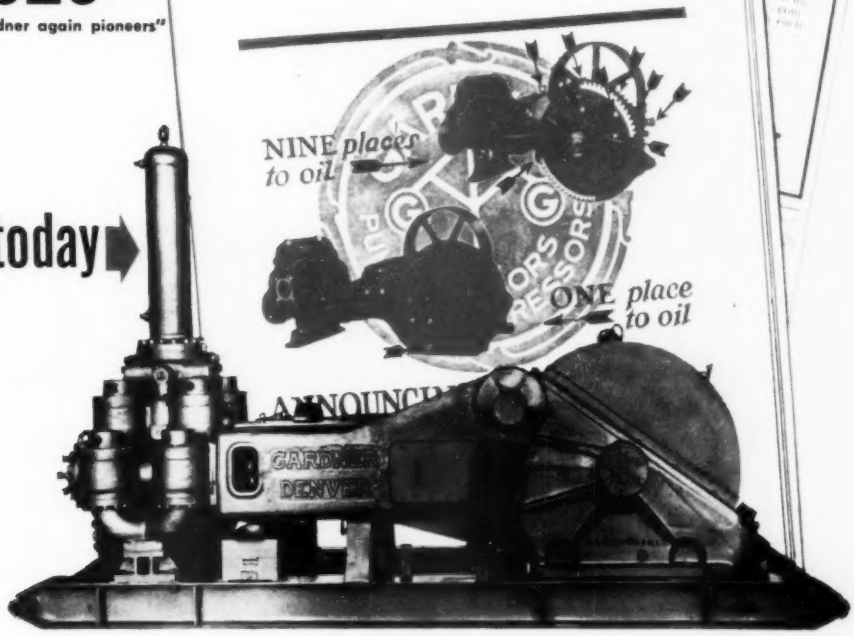
valve bolts in the

1925

"Gardner again pioneers"

THE OIL AND GAS JOURNAL

and today



Gardner-Denver Slush Pumps—constantly kept up-to-date—are still first choice among oil men who demand the best.

That's because these sturdy pumps are designed and built by men who know from experience just what it takes to keep mud circulating when you're drilling deep.

Write today for the full story behind the preference for Gardner-Denver Slush Pumps.

SINCE 1859

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada:
Gardner-Denver Company (Canada), Ltd., Toronto, Ontario
THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

CUT COSTS

Hose

RAY-MAN ROTARY HOSE

High tensile steel wire, wound under precisioned tension, gives this hose super flexibility. Stronger and less bulky than old-style rotary hose, it offers greater safety and longer service, is easier handled and less likely to be damaged. A built-in coupling with a leakproof "Lip-Lok" seal helps to make it the best investment for your rotary drilling rigs. Among many other hoses especially made by R/M for the gas and oil industry are Mud Pump Suction Hose, Fire Hose, and Ship Loading Hose.

For full information on R/M's complete line of asbestos and rubber products for petroleum, write for Catalog 6903A.

Raybestos-Manhattan, Inc., Passaic, New Jersey.

R M

RAYBESTOS-MANHATTAN, INC.

WITH RAYBESTOS-MANHATTAN

Asbestos and Rubber Products

Engineered right up to the latest demands of high powered rotary rigs. The strength members, improved with rayon, are imbedded in a neutral axis of heat-dissipating Flexlastics so that every belt runs cool, despite flexing. Prestretching prevents laggard belts and unbalanced strain while on the job. Other important products in the R/M line are the API Compensated Belts with equalizing ply stresses and the Endless Whipcord Belts with patented Extensible-Tips to prevent end seam opening.

These uniformly woven asbestos blocks, impregnated with a new saturant, have nonmetallic wearing surfaces and wire inserted backs for strength. Under any working conditions their performance is smooth and positive. Even at high temperatures they resist bleeding and feed-off smoothly. They won't carbonize, won't glaze drums even when heavily overloaded. Available with R/M's patented Key-Lok . . . the labor-saving feature that enables you to slide the blocks on and off . . . or conventionally drilled and countersunk.

Vee-Flex Rings are specially engineered for hydraulic and fluid-handling equipment in oil field, pipeline, refinery, and oil distributing service. They are available in endless and split rings, or spiral form, and are used on a great variety of valves, pumps, hydraulic cylinders, rams, presses and similar equipment. Five types provide sealing against all pressures encountered in the petroleum industry today. R/M makes a complete line of packings and gaskets for the petroleum industry.

Manufacturers of Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Hose • Mechanical Rubber Products • Rubber Covered Equipment • Asbestos Textiles • Packings • Powdered Metal Products • Abrasive and Diamond Wheels • Bowling Balls

SPECIALISTS IN ASBESTOS AND RUBBER PRODUCTS

Even Under DIFFICULT OPERATING CONDITIONS

NEW DEAL SPECIALTY PRODUCTS
Will Help You Get the Job Done!

Necessity has certainly been the mother of invention in the oil industry. Deeper depths, heavier loads, higher speeds, bigger volume and greater pressures have increased the hazards to human life and property. We are proud of the privilege to work with the oil industry in the solution of some of its drilling problems.

We pledge our experience, skills and facilities to the further improvement of oil field operations through new and better products.

DEEP WELL

CASING ELEVATORS
CASING SPIDERS
DEADLINE ANCHOR CLAMPS

USED AROUND THE WORLD
OILFIELD
NEW DEAL SPECIALTY CO.
EQUIPMENT
OKMULGEE, OKLA.

BUTLER TYPE

Casing SLIPS Elevator
(With or Without Buttons)
TUBING ELEVATORS AND SPIDERS
DRILLING CLAMPS

And Other World Famous New Deal Specialty Equipment
FOR SALE through YOUR FAVORITE SUPPLY STORE or EXPORT AGENT

The NEW DEAL SPECIALTY CO.
INC.
OKMULGEE, OKLA., U.S.A.

EARTH-QUESTING FINGER
Man's search for oil leads him ever deeper into the earth.
Today it is not uncommon for drill pipe turning around at high speed to thrust two miles or more into the earth. Yet, so constant has been progress that equipment takes the most crippling punishment in its stride.
Much of this efficiency is due to the smooth functioning of ball and roller bearings which keep friction at a minimum. SKF has made important contributions to the efficient operation of oil field equipment. Through development and research, SKF is able to supply the bearing best fitted to the job, anticipates industry's needs for bearings to handle ever harder jobs. 7246
SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.
— manufacturers of SKF and HESS-BRIGHT bearings.
SKF
BALL AND ROLLER BEARINGS
8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY
Integrity
Craftsmanship
Metallurgy
Tolerance Control
Surface Finish
Product Uniformity
Engineering Service
Field Service

THE GREATEST OIL FIELD IN THE WORLD

IT is not a new discovery that dwarfs the finding of Spindletop.

It lies not beneath an Arabian desert, a Rumanian plain or the ocean floor.

It is the "oil field" which exists in the minds of men.

Here is the richest reserve of oil—the source of constant discoveries of new ways to make oil do more.

They come from the men who produce or refine oil—and those of the Southwest have played a major role in this.

They come, too, from those who make the things that use oil. At General Motors, for example, we have worked on such developments as tetraethyl lead, high-compression engines and Diesel engines—cooperating always with the oil industry.

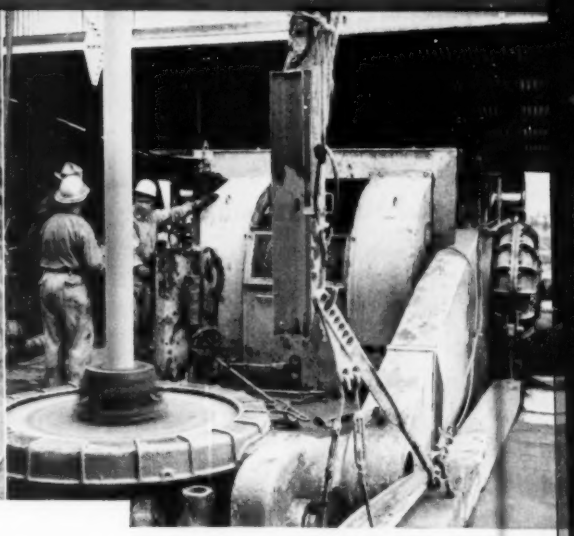
So we join in this year's salute to the 50th anniversary of "the discovery that made oil an industry." We know that the Petroleum Age is just beginning—for we know there are no boundaries to the greatest oil field in the world.

GENERAL MOTORS

CHEVROLET • PONTIAC • OLDSMOBILE • BUICK • CADILLAC • BODY BY FISHER
GMC TRUCK & COACH • CLEVELAND DIESEL • DETROIT DIESEL • ELECTRO-MOTIVE

LINK-BELT Chain *Rolls On!*

R.Y. SMITH
103
1905
This Link-Belt Detachable Chain was the first ever used on a rotary drilling rig. Photo above shows a drilling rig operating in the Sour Lake, Texas field in 1905, equipped with this chain.



Yesterday *and Today*

1951

Today Link-Belt Chains still set the pace for driving fast, heavy-duty rigs down to "pay."

Pictured here is a story of progress in the fabulous oil industry . . . . from a struggling infant to a scientific giant.

Spindletop is in its 50th year. It gave the world its first gusher oil on January 10, 1901, opening the way for modern transportation and uncountable other steps toward better living.

Link-Belt is in its 76th year. Link-Belt began making chain in 1875, the company being founded upon the invention of Ewart Detachable Link-Belt, illustrated on the left, which was exhibited in 1876 at the Philadelphia Centennial along with the first "approved" bicycle. Edison and Steinmetz were still unknown; locomotives were crude "iron horses;" the "horseless carriage" wasn't even in the dream stage.

Link-Belt Chain served as the drive on the first rotary drilling rig. Link-Belt Chains have kept pace year after year with the march of progress in oil. They have met every new demand as drilling depths went deeper and drilling loads grew heavier. In 1950 Link-Belt Chains served as the drive on the only well drilled below 20,000 feet. Our scientific research in chain keeps making new highs in power drive performance and will continue to do so . . . . for Link-Belt will never stop improving chain.

LINK-BELT COMPANY

Indianapolis 6, Dallas 1, Houston 1, Los Angeles 33, Kansas City 8, Mo., New York 7, Toronto 8.
Distributors in all fields. 12,309

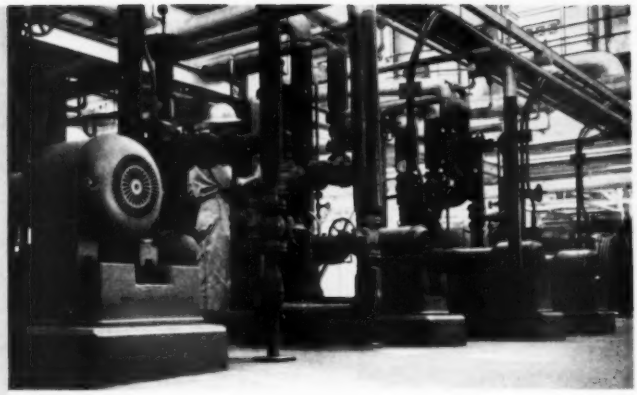
LINK-BELT

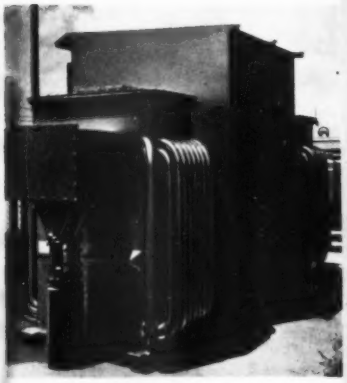
CHAINS AND SPROCKETS

Wagner
TRANSFORMERS and MOTORS

...time-tested favorites of the

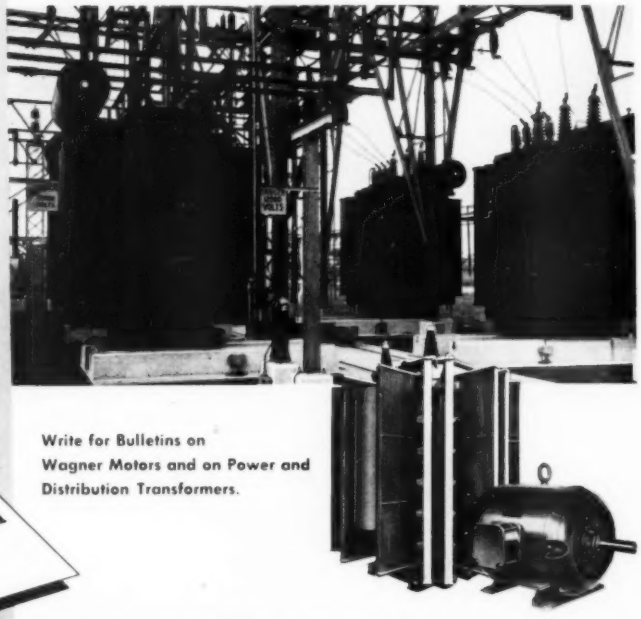
Petroleum Industry





Wagner Electric Corporation is proud of the part its products have played in the growth of the oil industry. In remote spots, oil well pumping rigs operate unattended, powered by Wagner oil well pumping motors —in the spectacularly modern refineries, Wagner transformers help supply power and Wagner motors convert this power into millions of man hours of labor. Wagner transformers and motors — since Spindletop — have been "part of the picture" in all phases of the petroleum industry.

In the petroleum industry, as well as in all types of manufacturing plants throughout the world, Wagner products are serving faithfully, upholding the Wagner reputation for quality and dependability.



Write for Bulletins on Wagner Motors and on Power and Distribution Transformers.

® Wagner Electric Corporation 1891 1951

Wagner Electric Corporation
6389 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.

DOWN THROUGH THE YEARS

OF GREATEST OIL INDUSTRY DEVELOPMENT

—WITH DIAMOND ROLLER CHAIN

SPINDLETOP MIGHT NEVER HAVE BEEN DISCOVERED

● While the Spindletop oil discovery at 1020 feet marked the greatest step in the oil development in America—this might never have happened if drilling to depths common today—5,000, 10,000 and more feet—had been required. The crude equipment then available plus the much greater costs of deep drilling might have blocked the venture.

The impetus given by Spindletop was felt in every direction. Better equipment, increased power units, greater speed of operation, and more efficient and longer-life dependability of power transfer became necessary.

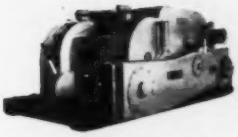
During this period of development precision-produced Diamond Roller Chains began to be adopted, being applied with the aid of Diamond's engineering staff in the early '20s for servicing winches, sand reels, and rig fronts for cable tool drilling.

Following this, Diamond Roller Chains were adopted for single- and double-reduction pumping units. The use of high capacity compact internal combustion engines for rotary drilling rigs and mobile units further emphasized the lower cost power transfer qualities, the great strength and the long-life dependability of these chains.

Since then, throughout the important years of the oil industry's growth, Diamond Roller Chains have well earned the top place given them by oil country machinery builders and contractors.

DIAMOND CHAIN COMPANY, Inc.
Dept. 475, 402 Kentucky Avenue
Indianapolis 7, Indiana
Tulsa Office: 2238 Terwilleger Blvd.
Offices and Distributors in All Principal Cities
Refer to the classified section
of your local telephone directory under the heading
CHAINS or CHAINS-ROLLER

And On The Very Latest Oil Field Drilling, Servicing and Pumping Rigs



Late model Unit Rig for deep depths.

Modern Wilson Giant Roadmaster Rig.

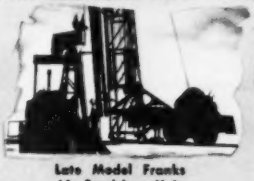
Cardwell Model 0 Draw Works.

Failing Holemaster "2500" Drill.

Happy Company late type Pumping Unit.

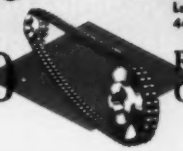
Fred Cooper two-drum Tractor Spudder.

Modern Mayhew Model 1000 Rig.



Late Model Franks 44 Servicing Unit.

Parkersburg Rig Pumper.

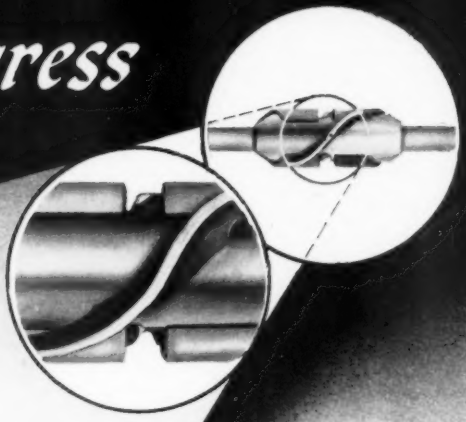


DIAMOND ROLLER CHAINS

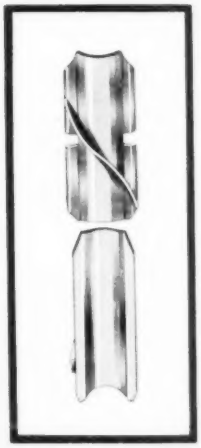
Sign of Progress

THE NEW S-I-W M-25

PARAFFIN SCRAPER



Development of the oil industry since Spindletop has been accompanied by great improvements in oil production problems. One of these . . . paraffin control . . . has received close study and the right answers from the Sunshine Iron Works of Odessa. Paraffin meets its match today in the new S-I-W M-25 Paraffin Scraper, for use on rods in pumping wells. It scrapes paraffin from the hole with a grip-tight shaving action. Easy to install, economical to operate, M-25 Paraffin Scrapers beat paraffin where it helps most . . . in the well!



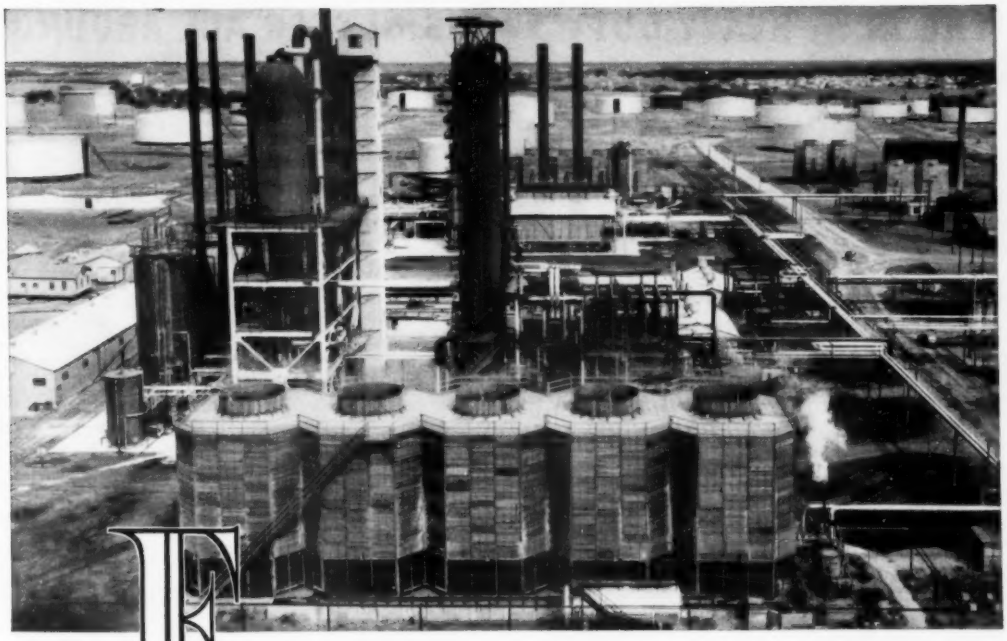
- NEW DESIGN
- GRIP OF STEEL
- LONGER WEARING

Sunshine Iron Works

601 W MURPHY - PHONE 4374 - ODESSA, TEXAS

SERVING THE OIL INDUSTRY FOR 26 YEARS

OIL FIELD REPAIRS • MANUFACTURERS OF OIL FIELD SPECIALTIES



From Kansas Prairie to Petroleum Center

Thirty-one years ago Skelly Oil Company came into being at El Dorado, Kansas. We could write volumes about Skelly's continuing growth and influence in the oil industry since then. We could print millions of words describing Skelly's never-ending efforts to better its products and services to the American public through the years.

But we feel the above picture of our mammoth thirteen-million-dollar El Dorado refinery expansion project portrays these points far more graphically.

In every sense of the word, this gigantic effort, rising majestically from Kansas prairie land, is a *milestone* in Skelly's highway of progress.

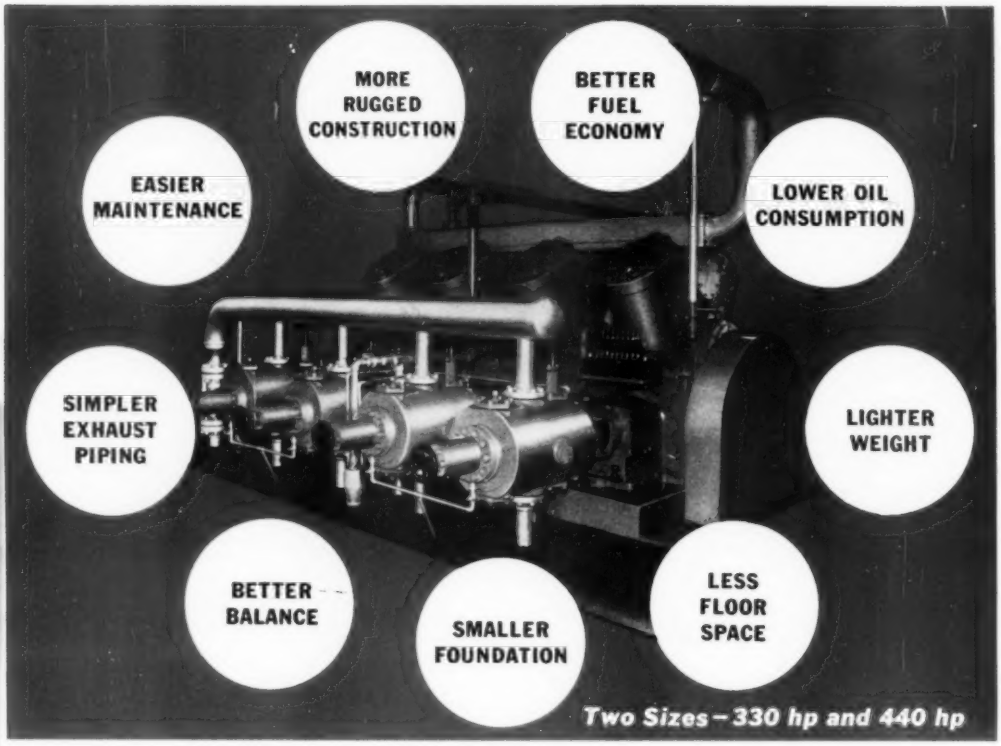
It is significant to every one of our friends, associates and customers, because it gives us, in this our Thirty-first Anniversary Year, our greatest single opportunity for providing the highest quality petroleum products—in the greatest possible volume—that modern equipment, technical skill and experienced personnel can produce.

31 Years of Petroleum Progress

SKELLY OIL COMPANY

WHOLESALE DIVISION OFFICES: KANSAS CITY · CHICAGO
MINNEAPOLIS · OMAHA · DENVER · DALLAS

THE NEW, HEAVY-DUTY SVG IS BETTER ALL AROUND



developed for:

ECONOMY
LOW-COST INSTALLATION
FLEXIBILITY
MAXIMUM DEPENDABILITY
QUIET PERFORMANCE
COMPACTNESS
EASE OF OPERATION
EASY RELOCATION

The *new SVG* gas-engine-driven compressor is essentially the well-known XVG 4-cycle V-angle compressor . . . improved and modernized by a complete redesign from the ground up and from the inside out.

For twenty years the famous XVG compressor has maintained its position as a standard of comparison. Time after time new developments were incorporated into the XVG construction, but there are limits to improving an existing model. There comes a time when a departure from even such a successful model is necessary.

The *new SVG* retains all of those features that have been so successful in the XVG, and takes advantage of new materials, modern rotative speeds, up-to-date manufacturing methods, and "know-how" based upon many years of experience in building both compressors and engines. The *new SVG* is the modern-design gas-engine-driven compressor with an outstanding background . . . a better compressor, all around.

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.

A HALF CENTURY OF PROGRESS

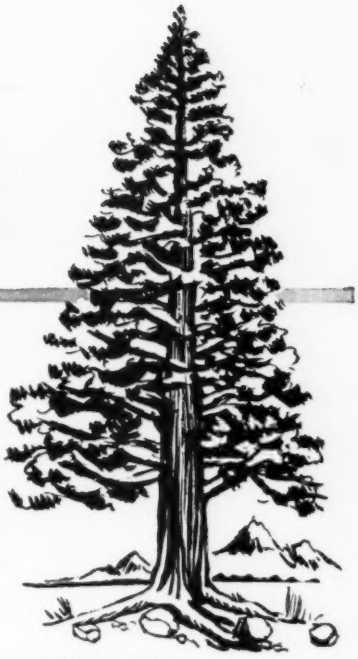
The present day oil industry was born at Spindletop in 1901. The first Ingersoll-Rand compressors used by the infant oil industry were belt driven by separate gas or steam engines.

Present day I-R gas-engine-driven compressors, such as the SVG, are as far advanced from those early belt-driven units as the modern oil industry is advanced from the original Spindletop.

4-CYCLE

376-6

husky youngster with STAYING POWER



50 years ago our roots went deep, with sixteen years' experience back of us in engineering, design and construction for important industries. Then came "Spindletop" and a whole new industry sprang into being. As the gas and oil industry grew, our services to this industry grew; our roots went deeper and took firmer hold on the industrial life of the country.

Contracts were offered which fixed the total responsibility within one organization—*for Engineering*, including design and processing work, *for Fabrication* of special processing equipment in our own shops, and *for Field Construction* with our own personnel and equipment.

In 1929 Stearns-Roger built the first sizeable high pressure absorption plant. That was for the Louisiana Gas & Fuel Company at Alto, La. Recently Stearns-Roger completed the third unit of the Katy Recycling Plant (owned by more than thirty gas and oil companies) handling more than 500 million cubic feet of gas per day. In the years between, the constantly increasing number of plants designed and constructed for the gas and oil industry is concrete evidence of Stearns-Roger's "staying power" in a field that demands study and diligent effort to keep abreast of its needs.

Complete plants and expansion to existing plants for...

- NATURAL GASOLINE EXTRACTION
- DISTILLATE RECOVERY • GAS DEHYDRATION
- GAS SWEETENING • SULPHUR RECOVERY
- GAS COMPRESSOR STATIONS

Stearns-Roger

THE STEARNS ROGER MFG. CO. DENVER COLORADO

Denver • Houston • El Paso

ENGINEERS • CONTRACTORS • MANUFACTURERS

18 Sales Offices 6 Resident Salesmen } plus

OUR VERY FIRST STORE

opened in May, 1905 at Bartlesville, Oklahoma, when it was known as Indian Territory. Today this same store is still doing a very active business in the original building.

OUR FIRST TEXAS STORE

opened in August, 1911 at Electra, Texas, but not in its present building. This first Texas store is now one of 27 stores in the Lone Star State alone.

OUR NEWEST STORE

opened in August, 1950 at Ballinger, Texas. This latest store has the distinction of being our 80th supply store. All of them have been carefully located for your convenience.

80 STORES

provide

ONE STOP

Supply Service In U. S. and Canada

Member PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

Jones & Laughlin Supply Company

"... here's MY warehouse!"

Subsidiary of
Jones & Laughlin
Steel Corporation

J&L STEEL

TULSA . OKLAHOMA

EXPORT: 405 LEXINGTON AVE., NEW YORK, N. Y., U.S.A.

Use the Jones & Laughlin Supply Point Nearest You

ARKANSAS
El Dorado

COLORADO
Craig — Rangely (Pump Shop Only)
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ILLINOIS
Carmi — St. Elmo
Clay City — *Chicago
Salem — †Mt. Vernon

KANSAS
Bushton — Russell
Chase — Winfield
El Dorado — *Wichita
McPherson — †Great Bend

KENTUCKY
Henderson

LOUISIANA
Bunkie — Lake Charles
Harvey — Rodessa
Houma — Shreveport
†New Orleans

MICHIGAN
Mount Pleasant — Reed City

MONTANA
Cut Bank

MISSISSIPPI
Brookhaven — Laurel

Oil City

NEW MEXICO
Artesia — Hobbs

NEW YORK
Bolivar — *New York City

OHIO
Canton — Lodi

OKLAHOMA
Bartlesville — Okmulgee
Crescent — Pauls Valley
Cushing — Perry
Duncan — Seminole
Healdton — Tulsa
Muskogee — †Ardmore
Nowata — *Ponca City
Oklahoma City — †Wewoka

PENNSYLVANIA
Bradford — Pleasantville
Clarion — Waynesburg
*Pittsburgh

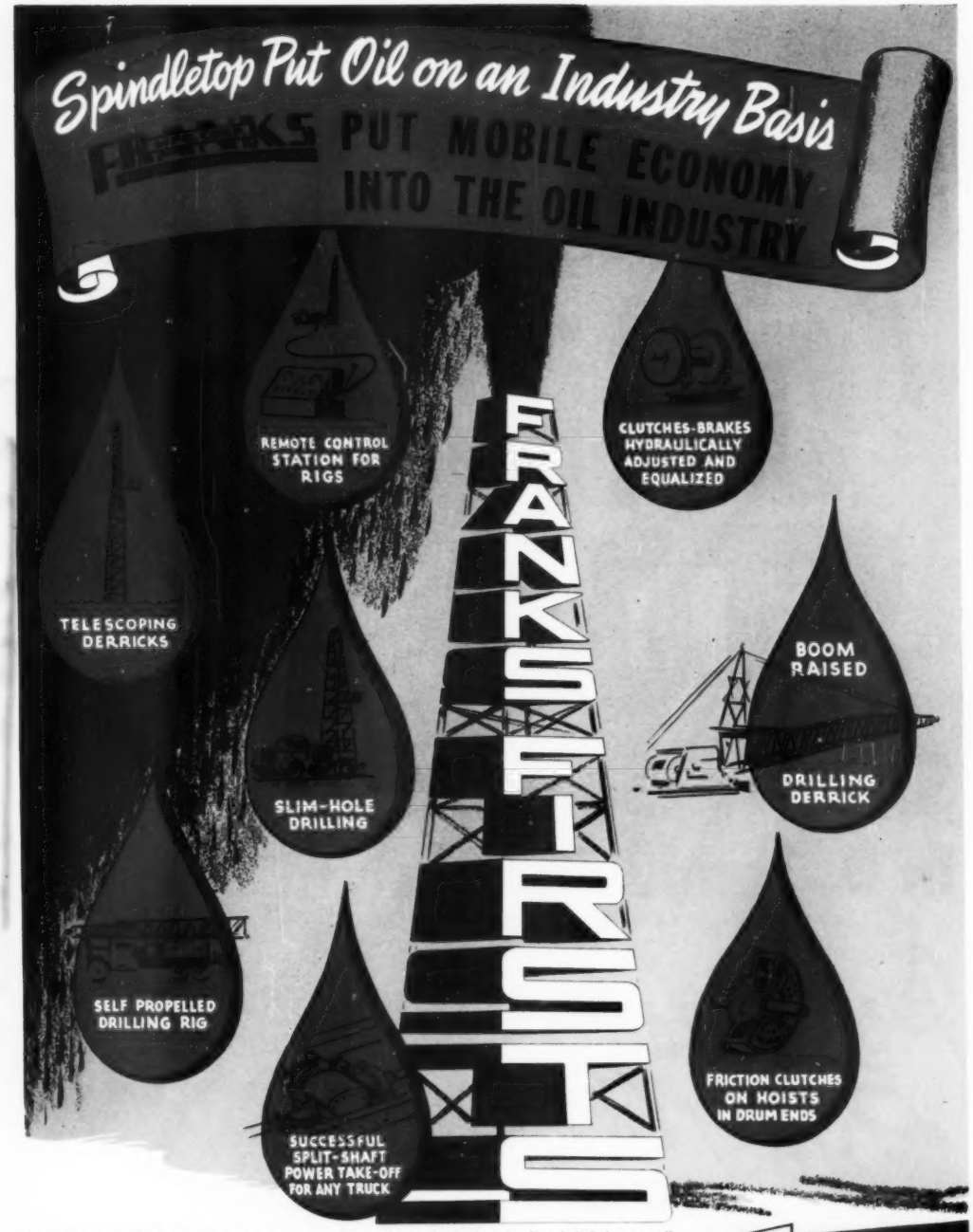
TEXAS
Alice — Mexia
Anson — Muenster
Ballinger — Odessa
Beaumont — Olney
Best — Overton
Big Spring — Pampa
Borger — Pleasanton
Corpus Christi — Snyder
Electra — Sundown
Freer — Tulco
Gladewater — Wichita Falls
Houston — *Abilene
Kermit — *Amarillo
Kilgore — *Dallas
Longview — *Ft. Worth
(Willow Springs) — *Midland
Luling — *San Antonio

WEST VIRGINIA
Clarksburg — Pineville

WYOMING
Casper — Powell
†Cody

CANADA
Edmonton, Alta. Stettler, Alta.
*Calgary, Alberta

*Offices. †Representatives.


Spindletop Put Oil on an Industry Basis
FRANKS PUT MOBILE ECONOMY INTO THE OIL INDUSTRY
REMOTE CONTROL STATION FOR RIGS
CLUTCHES-BRAKES HYDRAULICALLY ADJUSTED AND EQUALIZED
TELESCOPING DERRICKS
BOOM RAISED
DRILLING DERRICK
SLIM-HOLE DRILLING
SELF PROPELLED DRILLING RIG
FRANKS FIRSTS
FRICTION CLUTCHES ON HOISTS IN DRUM ENDS
SUCCESSFUL SPLIT-SHAFT POWER TAKE-OFF FOR ANY TRUCK

The Franks Manufacturing Corporation came into being during 1931, thru the firm belief that a well-built product assuring savings to cost conscious customers, would receive wide acceptance. That this belief was well founded, even in a severe depression period, is thoroughly attested by the ever-growing list of Franks users which includes the principal independent and major operators in all parts of the world. Always refusing to be bound by precedent and so-called "accepted practices", Franks has created, in collaboration with its customers, many firsts, which have virtually revolutionized equipment and practices in the drilling and servicing of oil wells. These "firsts" and many other improvements have put mobile economy into the oil industry and have made Franks equipment the "last word" in modern streamlined portable servicing and drilling equipment.

FRANKS MFG. CORP.
WELL SERVICING AND DRILLING UNITS
TULSA, OKLAHOMA

FROM INGOT TO FINISHED ROPE:

there are no gaps in our

Quality Control

Quality control of Wickwire Rope is *complete and uninterrupted* from the actual smelting of our own iron and steel to the final making of the finished rope.

Only a company like C. F. & I. with its constant checking, testing and inspection through every step of manufacture can give you the big advantages that are derived from a constant and uniform size of steel grain in each grade of finished rope wire. When you specify Wickwire Rope you're sure of wire rope that's unequalled for safe and unfailing performance . . . longer, more economical and uniform service on the job.

LOOK FOR THE YELLOW TRIANGLE ON THE REEL

WICKWIRE ROPE

A PRODUCT OF WICKWIRE SPENCER STEEL DIVISION OF THE COLORADO FUEL AND IRON CORPORATION

WIRE ROPE SALES OFFICE AND PLANT—Palmer, Mass. **EXECUTIVE OFFICE**—500 Fifth Avenue, New York 18, N. Y.

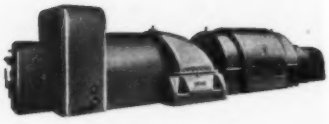
SALES OFFICES—Abilene (Tex.) • Boston • Buffalo • Casper • Chattanooga • Chicago • Denver • Detroit • Emlenton (Pa.) • Houston • New York Odessa (Tex.) • Philadelphia • Phoenix • Salt Lake City • Tulsa

PACIFIC COAST SUBSIDIARY—The California Wire Cloth Corporation, Oakland 6, California

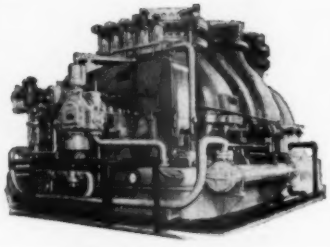
Congratulations

...to one fifty-year

TUBE CLEANERS

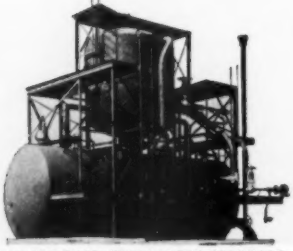


TURBINE GENERATORS



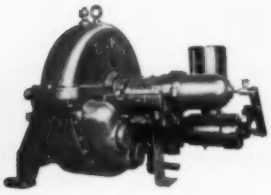
CENTRIFUGAL BLOWERS

STEAM JET EJECTORS



DEAERATING FEEDWATER HEATERS

TURBOCHARGERS FOR DIESELS



MECHANICAL DRIVE TURBINES

SYNCHRONOUS MOTORS & GENERATORS

EXPLOSION-PROOF MOTORS

veteran from another!

HALF CENTURY OF POWER PROGRESS

1901 1951

Looking back fifty years, Elliott Company, beginning in a very small way as a manufacturer of boiler tube cleaners, at first had only this product to offer the young oil industry. With the appearance of pressure stills, about 1919, Elliott Company was ready to develop the special heavy-duty tube cleaners required for removing hard coke deposits from still tubes and other pipes around the refinery. Since that time, continually improved Elliott-Lagonda tube cleaners have been getting stills back on stream in jig time. Meanwhile an expanding line of steam, electrical and process equipment has included many products which have played their part in the oil industry's march of progress, including those illustrated at left.

Looking ahead, the Elliot Company continues to plan and improve its full line of equipment. Continual engineering development work assures you of being "A Step Ahead With Elliott."

Q-1155

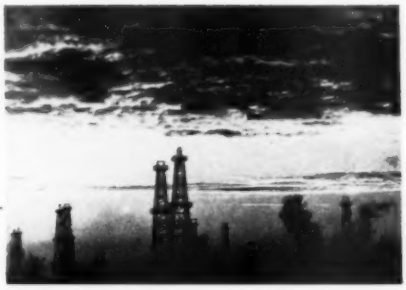
ELLIOTT COMPANY

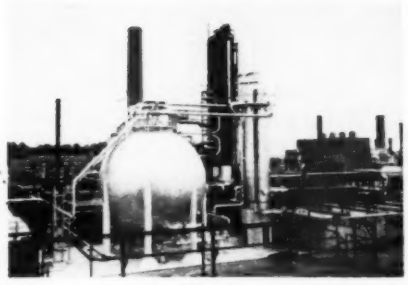
JEANNETTE, PA.

PLANTS AT: JEANNETTE, PA.
RIDGWAY, PA. • AMPERE, N. J.
SPRINGFIELD, O. • NEWARK, N. J.

District Offices in Principal Cities

SPINDLETOP THE BEGINNING OF THE OIL ERA





Spindletop was the birthplace of oil development on the Gulf Coast — a development that led to the discovery of many prolific Gulf Coast and Mid-Continent fields, the construction of large-scale pipe lines, the building and growth of great refineries.

The flush production of Spindletop and the other great Gulf Coast and Mid-Continent fields changed early refining procedures. Kerosene, then the principal refinery product, was superseded by gasoline; the pipe still was introduced; later, reforming was applied; then came catalytic cracking. All these, and many more, were the steps toward modern refining efficiency which were fostered by the Spindletop discovery.

As refining techniques became more precise, refiners insisted on a clean crude charge, free from harmful salts. Many leading refiners everywhere, to assure themselves of desalting dependability, efficiency and service, rely on

PETROLEUM RECTIFYING COMPANY
5121 SOUTH WAYSIDE DRIVE, HOUSTON 3, TEXAS
1390 EAST BURNETT STREET, LONG BEACH 6, CALIFORNIA

PETRECO

SPECIALIZED *Electric* PETROLEUM PROCESSES (DESALTING / DEHYDRATING)

When the famous LUCAS GUSHER blew in... S. M. JONES was there!

One of the first supply stores in Beaumont, which had been opened by S. M. Jones, President of the Acme Sucker Rod Co. early in 1900, was humming with activity on that momentous morning of Jan. 10, 1901.

In the words of Mr. A. W. Hamill, the driller on the well: "While we were having breakfast (at the house of Mr. Lucas) the first oil men arrived at his house on the way to see the well. They were J. S. Cullinan, S. M. (Golden Rule) Jones and T. J. Wood."

Pioneers in the supply business, having also opened the first oil well supply store in the State of Texas area at Corsicana, Texas in 1897, Jones has since pioneered practically every major advance in the development and use of sucker rods. When you specify Jones Sucker Rods you get the best.

Today, Jones sucker rods are a familiar sight in most fields where they are depended upon for outstanding service under all conditions—in wells of all depths.

THE S. M. JONES COMPANY *Division of Buffalo-Eclipse Corporation*
General Office and Factory: TOLEDO, OHIO
SALES OFFICE: Kennedy Building, Tulsa, Okla.
EXPORT SALES OFFICE: Buffalo International Corp., 30 Church Street, N. Y. C.

LOOK FOR THE GREEN RODS!

JONES
SUCKER RODS
Best in the Field

Cummins® Custom-built Diesels

Built not once but Twice

Best buy in power is the engine that's built best

Cummins Diesels have an outstanding record *and* reputation in a wide range of Diesel applications. And here's one reason!

Rugged, lightweight, high-speed Cummins Diesels perform better because they're built better, under strictest quality control methods. Moreover, each engine is actually built twice! After initial assembly, each engine is run in on the test block. Then it is torn down and carefully re-inspected — and after that it is re-assembled and tested *again*.

Such *extra* care in precision building . . . Cummins exclusive fuel system . . . reliable world-wide service and parts organization . . . enable Cummins users to get peak performance . . . less "down-time" and *more* rugged, dependable power.

Better contact your Cummins dealer. He has more facts to show you about making more profits.

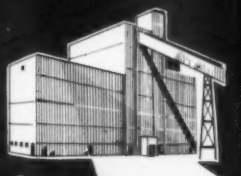
Diesel power by CUMMINS

CUMMINS Diesel

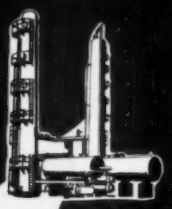
CUMMINS ENGINE COMPANY, INC. • COLUMBUS, IND.

EXPORT: CUMMINS DIESEL EXPORT CORPORATION
Columbus, Indiana, U. S. A. • Cable: Cumdiex

Lightweight High-speed Diesel Engines (50-550 hp) for: On-highway trucks • off-highway trucks • buses • tractors • earth-movers • shovels • cranes • industrial locomotives • air compressors logging yarders and loaders • drilling rigs • centrifugal pumps generator sets and power units • work boats and pleasure craft.

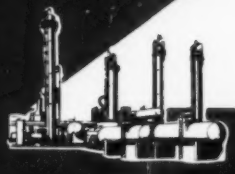


Power

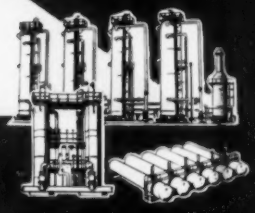


Chemical

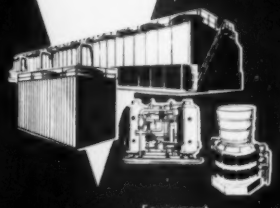
Outstanding in Industry



Petroleum



Natural Gas



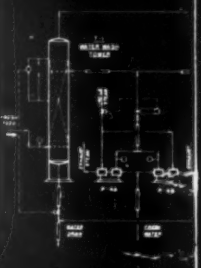
Equipment

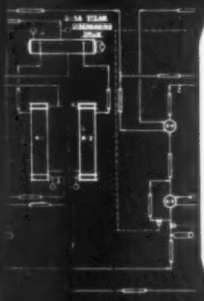
design,
engineering,
construction
and processing services

J.F. Pritchard & Co.

Outstanding Ability...

J. F. Pritchard & Co. is staffed by a group of thoroughly trained and experienced engineers, all with intensive knowledge of various processing industries and the specific unit operations involved in each. Our wealth of technical "know-how" and experience gained from numerous operating plants which we have designed, engineered and constructed during the past quarter of a century is your assurance of our *outstanding ability* to serve the industry.



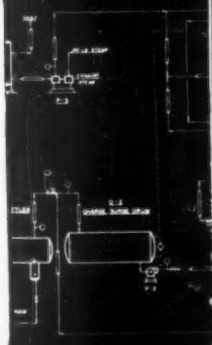


Outstanding Performance...

Pritchard-built plants are *outstanding* for their low cost, operating efficiency and production to the *exacting* quality standards set by the customer. Superiority of product . . . maximum plant efficiency . . . ease of operation . . . longer periods of continuous production with freedom from maintenance troubles . . . these are the things for which Pritchard-built plants are known in industry today.

Outstanding Services...

Pritchard services are *flexible*. If you desire complete "turnkey" service which includes everything from Analysis of Requirements to final Operating Tests, Pritchard offers its *Single Responsibility Contract*. Any part of Pritchard's outstanding service is, of course, available separately. For those who desire to supplement the work of their own permanent engineering staffs and relieve them of the extra work load of new plant design, engineering, procurement or construction, Pritchard stands ready to assist as the project may require.



NATIONAL CONSTRUCTORS ASSOCIATION
MEMBER

J.F. Pritchard & Co.

ENGINEERS · CONSTRUCTORS · MANUFACTURERS

Dept. 121 – 908 GRAND AVE. – KANSAS CITY 6, MO.

Whether you are planning a complete new plant, or merely additions and modifications, Pritchard is eminently qualified to handle all elements of your project effectively and economically. We invite your specific inquiry.

YEARS BEFORE SPINDLETOP!

— LESCHEN produced the first successful wire rope drilling line. It was used by a Mr. Tom Neal near Amos, West Virginia.

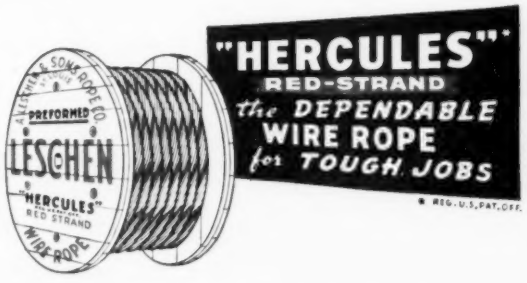
1857 . . . A. Leschen & Sons Rope Company was founded at St. Louis, Missouri.

1859 . . . The Drake well in Pennsylvania was brought in, marking the beginning of large scale oil production.

1895 . . . The first successful wire rope for drilling was produced by A. Leschen & Sons Rope Company.

1901 . . . The Spindletop field at Beaumont, Texas, was discovered, which marked the beginning of important oil production in Texas and the Southwest.

Years before the discovery of the Spindletop field, LESCHEN Wire Rope had been used for drilling oil wells. In fact, the first successful Wire Drilling Line was a LESCHEN Wire Rope. Long experience in the manufacture of wire rope has enabled LESCHEN to keep abreast of the rapid strides made by the great oil industry, and to provide the correct wire line to fit new equipment and methods as they have come into use. So it is with much pride that LESCHEN points to the performance record of "HERCULES" Wire Rope—both at home and abroad. Its one Red-Strand has long been recognized as a dependable guide to safe and economical wire rope service.



MADE ONLY BY

We Invite Your Inquiries

A. LESCHEN & SONS ROPE CO. 5909 KENNERLY AVE. • ST. LOUIS 12, MO.

ESTABLISHED 1857

New York 6 · Chicago 7 · Birmingham 6 · Houston 3 · Denver 2 · Los Angeles 21 · San Francisco 7 · Portland 9 · Seattle 4

SINCLAIR SALUTES THE SOUTHWEST ON THE GOLDEN ANNIVERSARY

★ ★ ★

Sinclair was started in the Southwest and for many of the last fifty years the Company's growth has closely paralleled the development of the oil industry in this area. Here are located two of our seven major refineries, one in Houston and the other in Corpus Christi. Corpus Christi is the southern terminal of the Sinclair Pipe Line System, which extends through Texas and Oklahoma north to East Chicago, Ind., and east to the Atlantic coast. Domestic crude production is largely in this area and the Company has recently made notable oil discoveries in Texas, Oklahoma and Louisiana.

SINCLAIR REFINING COMPANY

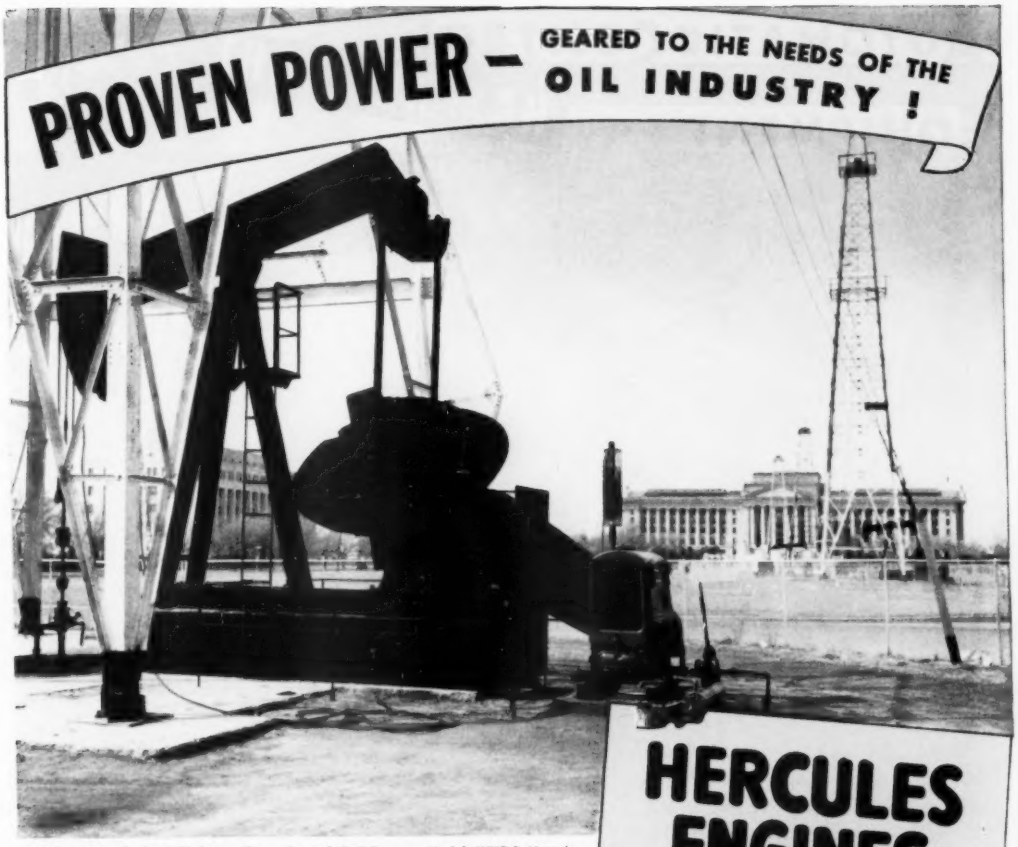
630 FIFTH AVENUE, NEW YORK 20, N. Y.

SINCLAIR H-C GASOLINE ®

first of the big fields—
SPINDLETOP!
first in
drill pipe, casing,
and tubing—
NATIONAL
SEAMLESS
We at NATIONAL Tube are proud to add our salute to Spindletop— and to the amazing strides the American oil industry has made since the Lucas Gusher blew in, fifty years ago. For in all this development NATIONAL Tube has been inseparably associated. Year after year, during this half century of progress, we have made available to the industry continually better and more efficient tubular products that have paralleled the advances made in the drilling, refining and transportation of petroleum.
The accompanying list of NATIONAL Tube's pioneering in drill pipe, casing and tubing alone, illustrates how closely our research program has reflected and successfully met the constantly more severe demands of the oil industry. It is indicative of the equally important improvements you can confidently expect from NATIONAL Tube in the years ahead.
NATIONAL TUBE COMPANY, PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK
NATIONAL TUBE firsts
Made the first steel pipe in this country
First pipe with seamless couplings
D. B. X and D. B. B Casing
Combination Casing Strings
Upset Drill Pipe and Tubing
Seamless Drill Pipe and Tubing
Electrogalvanized Couplings
"Rotary Rolled" seamless pipe
Round thread Drill Pipe, Casing & Tubing
Internal Upset Casing
Deoxidized Bessemer Steel Seamless Casing
First drill collars from seamless pipe
Worm Worked Casing
Deep Well Casing
WALLS WITHOUT WELDS
USS
NATIONAL SEAMLESS
drill pipe...casing...tubing
UNITED STATES STEEL

"No Shutdown in Two Years!"
Says the Master Mechanic of the K. B. Knox Drilling Company
The outstanding performance of Hercules Engines in oil field service is best told in the above statement from an on-the-job experience. Here a Hercules Model DFXE Diesel with a 895 cu. in. displacement operates the drill rig. Regardless of the work to be done in the oil field—if it requires power—it can be done with continuance and economy with high-speed, heavy-duty Hercules Diesel Engines.
HERCULES ENGINES
GAS • DIESEL • GASOLINE • 3 to 500 H.P.
Strategically located branches and distributors are at your service. Why not contact them today.
HERCULES MOTORS CORPORATION • CANTON 2, OHIO, U.S.A.
BRANCHES IN: Los Angeles, Calif., Salem, Ill., Houston, Odessa & Kilgore, Texas
OIL FIELD DISTRIBUTORS IN: Tulsa, Okla., Los Angeles, Calif., Shreveport & New Orleans, La., Alice, McAllen & Dallas, Texas

PROVEN POWER — GEARED TO THE NEEDS OF THE OIL INDUSTRY !



Within view of the Oklahoma State Capitol Building, a Model WXC-3 Hercules Power Unit pumps oil for the British-American Oil Company. It is one of hundreds of typical Hercules installations in the vast oil fields of America.

HERCULES ENGINES

3 to 500 H.P.

Drilling . . . pumping . . . production . . . transportation . . . wherever dependable power is an asset to oil field operation . . . one name stands out as a symbol of outstanding performance and economy. It is Hercules Power . . . high speed, heavy duty, gasoline, gas or diesel power that has "grown up" in the oil fields where it enjoys a wide reputation for reliable day-in, day-out rugged service. Hercules Engines and Power Units are built in a wide variety of horsepower ratings and piston displacements (see chart) to meet the broad, versatile and expanding needs of a still rapidly growing industry. Look over this list. There is a Hercules here to do justice to your power requirements — to reduce operating costs. Write for complete specifications covering the sizes and types of Hercules Engines of particular interest to you.

GAS AND GASOLINE ENGINES

Model	Bore and Stroke	Cu. In. Displ.
Two Cylinder		
BXB	2⅞" x 3"	39
NKA	3" x 4"	56.5
NXB	3⅛" x 4"	66.3
Four Cylinder		
ZXA	2⅝" x 3"	59
ZXB	2⅝" x 3"	65
IXA	3" x 4"	113
IXB	3⅛" x 4"	133
JX4E	3¼" x 4½"	133
JX4C	3¼" x 4½"	164
JX4D	4" x 4½"	188
	4" x 4¼"	214
Six Cylinder		
GXA	3⅛" x 4½"	190
GXB	3⅛" x 4½"	203
GXC	3⅛" x 4½"	205
GXLD	3 7/16" x 4½"	221
JXE	3" x 4½"	236.7
JXB	3⅛" x 4½"	245
JXC	3¼" x 4½"	263
JXD	4" x 4½"	282
JXLD	4" x 4½"	320
WXC-3	4¼" x 4½"	339
WXLC	4" x 4½"	383
WXLC-3	4¼" x 4½"	358
TDXB	4⅛" x 5¼"	404
RXB	4⅛" x 5¼"	474
RXC	4⅛" x 5¼"	501
RXLC	4⅛" x 5¼"	529
RXLD	4⅛" x 5¼"	529
RXLDH	4¼" x 5¼"	558
HXB	5" x 6"	558
HXC	5" x 6"	707
HXD	5¼" x 6"	779
HXE	5¼" x 6"	855
	5¼" x 6"	935

DIESEL ENGINES

Model	Bore and Stroke Inches	Piston Displ. Cu. In.
Two Cylinder		
DIXC	4" x 4½"	113.1
DIXD	4¼" x 4½"	127.5
Four Cylinder		
DIX4B	3⅛" x 4"	133
DIX4D	3⅛" x 4"	166
DOOJK	3¾" x 4½"	198.8
DOOC	4" x 4½"	226.2
DOOD	4¼" x 4½"	235
Six Cylinder		
DIX6D	3⅛" x 4"	249
DIXB	3⅛" x 4½"	260
DIXC	3¼" x 4½"	298
DIXHF	3¼" x 4½"	298
DWXD	4" x 4½"	298
DWXD	4¼" x 4½"	358
DWXLD	4¼" x 4½"	404
DWXLDF	4¼" x 5"	426
DRXB	4⅛" x 5¼"	426
DRXC	4⅛" x 5¼"	474
DFXB	5" x 6"	529
DFXC	5¼" x 6"	707
DFXD	5¼" x 6"	779
DHXE	5⅝" x 6"	855
DFXH	5¼" x 6"	893
DFXHF	5¼" x 6"	935
	5¼" x 6"	935
Eight Cylinder		
DNX V-8B	5¼" x 6"	1247
DNX V-8C	6" x 6"	1348
DNX V-8D	6¼" x 6"	1468
DNX V-8DS	6¼" x 6"	1468

Hercules POWER UNITS are available, equipped with any of the above engines.

HERCULES MOTORS CORPORATION, Canton, Ohio, U.S.A.

AUTOMATIC CONTROL EQUIPMENT

HAMMEL-DAHL

"ALL OUT PRODUCTION"

requires

HAMMEL-DAHL "KNOW HOW"

to solve your

Control Valve Problem

FLO-TESTED*
DIAPHRAGM CONTROL VALVE
3000 SERIES

These Standard Control Valves are designed for use with air operated instruments for control of pressure, temperature, liquid level, rate of flow, humidity or pH. They can be applied with equal efficiency on air, water, steam, oil, gas or chemical service and are available in sizes from ¼" to 12".

The ALLSTEEL Superstructure is fabricated from 3/16" steel stampings. Oilite Bearings eliminate spring stem friction. Stainless steel spring stem standard. Packing box bolted on all size valves. Bonnets and blind heads are forged fabricated. Bonnet will support ALLSTEEL Superstructure if installed horizontally. They are through-bolted for greater strength and also to provide simplicity of field reversal. All valve plugs are top and bottom guided in hardened stainless steel bushings. Valve action reversible in the field, requiring no additional parts.

Copyright, 1952, by Hammel-Dahl Company

HAMMEL-DAHL COMPANY

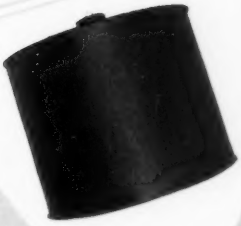
243 RICHMOND STREET, PROVIDENCE 3, R. I., U.S.A.

ALBANY BOSTON BUFFALO CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON KALAMAZOO KANSAS CITY KINGSPORT, TENN. LOS ANGELES NEW ORLEANS NEW YORK PITTSBURGH SAN FRANCISCO SEATTLE ST. LOUIS SYRACUSE TOLEDO TULSA WILMINGTON, DEL.

In Canada, Railway & Power Engineering Corporation, Ltd.

40 years ago...

1911



WE BUILT THE ORIGINAL BOLTED STEEL TANK...

1951

Down thru the years, since Maloney Tank Company was organized in 1909, we have been first in many innovations and improvements in tank, oil and gas separator, and emulsion treater construction and application.

MALONEY CRAWFORD

TULSA, OKLA.

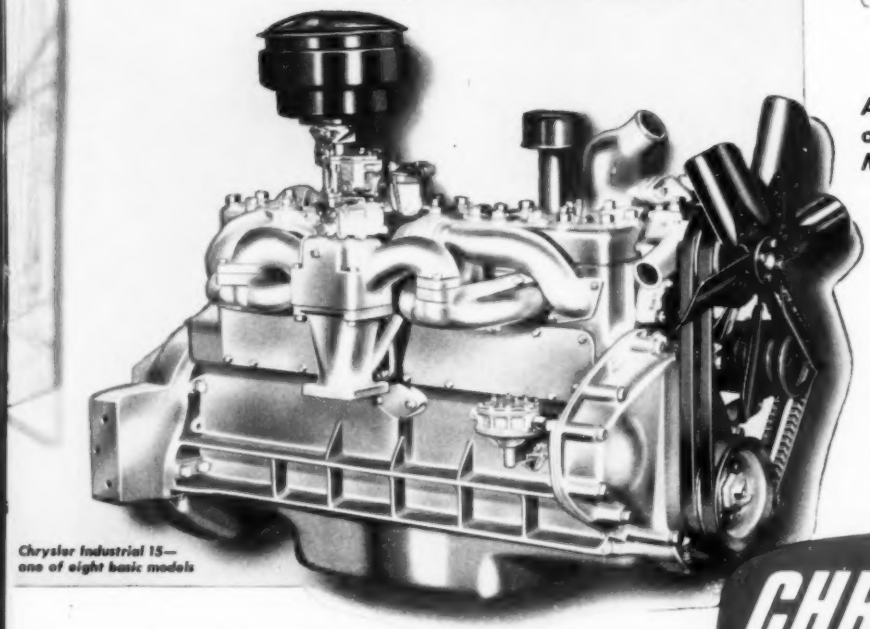
BIGGEST POINTS TO REMEMBER WHEN YOU BUY INDUSTRIAL ENGINES !

High Speed Operation Means
BETTER PERFORMANCE
Chrysler has it!

Mechanical Excellence Means
LOWER MAINTENANCE COST
Chrysler has it!

Large Mass Production Means
LOWER ORIGINAL COST
Chrysler has it!

Nation-wide Service Means
LESS DOWN TIME
Chrysler has it!



Chrysler Industrial 15—one of eight basic models

A few of the many outstanding Chrysler Mechanical Features

- All friction surfaces Superfinished by an exclusive Chrysler process.
- Statically and dynamically balanced Crankshaft.
- Sodium cooled Exhaust Valves.
- Stellite Exhaust Valve Seat Inserts.
- Stainless Steel Valve Springs.
- Chrome top Piston Ring.
- Completely waterproofed Ignition.
- By-pass thermostat Cooling System.

Among engineers who have *seen the difference in the field* there is no question about the superior performance and economy of high speed industrial power. Only remaining question is—"Who makes the high speed industrial engine most free from maintenance and most readily adaptable to our equipment at the lowest cost?"

The answer is leading more and more manufacturers to Chrysler, *first* to develop a higher speed engine, continuously *first* with the greatest number of important improvements. A letter of inquiry will bring a qualified engineer to your desk for discussion.

Industrial Engine Division, Chrysler Corporation, Detroit 31, Michigan.

PACIFIC CAST STEEL VALVES

Pacific Valves is proud to have played a part in the tremendous development of the Oil Industry in the Great Southwest

PACIFIC VALVES, INC.

3201 Walnut Avenue, Long Beach 7, California

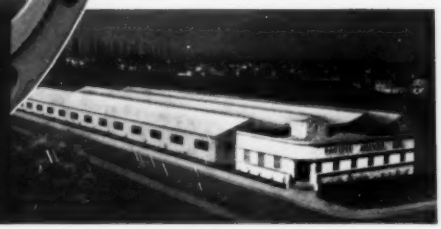
TELEPHONES: Long Beach - - - 40-5451; Los Angeles - - - NEvada 6-2325

TELETYPES: Long Beach 6-8076; Houston, Tex.: HO 489; N. Y. City 1-1077

BRANCH OFFICES: Houston, Texas; New York City, N. Y.

SALES OFFICES

San Francisco, Calif.; Seattle, Wash.; Salt Lake City, Utah; Denver, Colo.; Tulsa, Okla.; St. Louis, Mo.; Cleveland, Ohio; Pittsburgh, Pa.; Chicago, Ill.



Another "WILD" story we can all believe in . . .

FIFTY YEARS ago a Spindletop rancher rode into nearby Beaumont, Texas, to report a "wild oil well" out his way.

It was wild, all right—shooting oil 200-odd feet into the air at a rate of almost 100,000 barrels a day. As a cattleman, the rancher could hardly be blamed for failing to describe it for what it was: the world's mightiest oil well!

What at first was a poor thing for the rancher became overnight a great thing for the country. For "Spindletop" was the first of a series of fabulous oil discoveries that gave Americans great opportunities . . . Opportunities that brought "luxuries" within reach of millions, made new machines practical and gave new sinews to the nation's armed services.

Today, Tide Water Associated Oil Company joins other pioneers of the petroleum industry in marking the half-century significance of "Spindletop's" great contribution to a grateful nation.

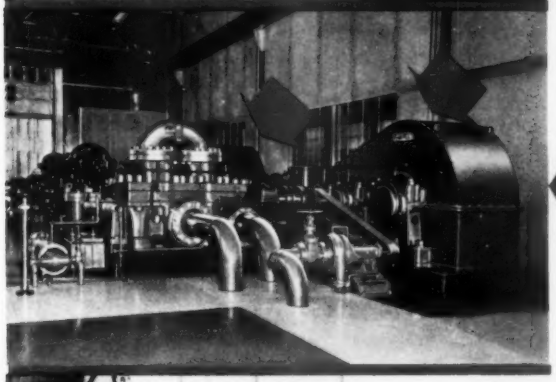
TYDOL FLYING GASOLINE — TIDE WATER ASSOCIATED OIL COMPANY — VEEDOL MOTOR OIL

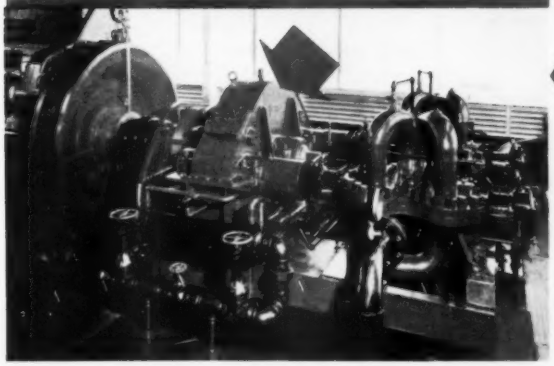
NEW YORK — THOMPSON BUILDING TULSA 2, OKLAHOMA — SAN FRANCISCO

Manufacturers of
Tydol Flying -A- Gasoline, Veedol & Tydol Motor Oils and Tycol Industrial Oils and Lubricants.

SUPPLYING THE IDEAL SPEED INCREASER FOR THE JOB

is a Farrel specialty





Since 1932, Farrel has worked closely with the oil industry in developing speed increasers to meet normal as well as unusual requirements.

The remarkable performance record of the hundreds of these units now in service has established a virtual guarantee of satisfaction. All of them, including the first installed 19 years ago, are still operating successfully.

Farrel Type SI units were the first speed increasers to be placed on the market in a standard series. The modern SI line consists of 49 standard sizes with speed ratios ranging from 1:1 to 12:1. For higher ratios, units using two sets of gears are supplied with ratio range from 12:1 to 40:1. Two-pinion units, designed to transmit power from a single engine to two pumps, are also available.

For further information, send for a copy of Bulletin No. 448A. No cost or obligation.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N.Y.

Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Cleveland, Detroit, Chicago, Portland (Oregon), Los Angeles, Salt Lake City, New Orleans

FB-659

SINGLE STEP-UP UNITS
transmitting 300 HP from internal combustion engines to centrifugal pumps.

DOUBLE STEP-UP UNITS
transmitting 1300 HP from 240 RPM engines to pumps operating at 3150 RPM.

TWO-PINION UNIT
delivering 300 HP to each of two pumps from a single 600 HP engine.

OIL FIELD REPRESENTATIVES:
Hercules-Lupfer Engine Sales Co., 124 N. Boston St., Tulsa 1, Okla.
V. W. Osborne, 860-A M&M Building, Houston 2, Texas

Farrel-Birmingham®

it's New! it's Different!

it's the strongest pipe wrench in the world!

–the revolutionary Walworth improved Walco®

Yes, this is it . . . the NEW Walworth *Improved* Walco pipe wrench–with every part scientifically designed and tested by engineers for strength, safety and ease of operation. Its instant bite, and accurately determined center of gravity, combine with its inherent strength and minimum of weight to make it the fastest-working, easiest-handling, best balanced, heavy-duty pipe wrench available today . . . a wrench specially designed to minimize operator fatigue.

All parts are made of forged steel. The housing and handle are projection welded–a structural weld–to form an integral unit. Both jaws are carefully machined, and all parts are heat-treated to give extra toughness, uniformity, and strength. Every Improved Walco far exceeds the requirements for Federal Specification GGG-W-651a for Type II Heavy Duty Adjustable Pipe Wrenches.

A flexible, double-acting, easily replaceable spring–an exclusive patented Improved Walco feature–gives the wrench fast, positive ratcheting action!

Ask your Walworth distributor about the new, Improved Walco today! Heft the new, Improved Walco . . . feel its perfect balance–every part is guaranteed by the Walworth Company, doing business since 1842.

Check these outstanding features

LIGHTER: Housing and Handle are projection welded to form one integral unit.

CORRECT BALANCE: Accurate, the correct location of the center of gravity determined by test.

STRONGER: Heat treated to eliminate brittleness . . . cracking.

FAST ACTING: Scientifically designed spring action insures positive ratcheting action . . . quick bite.

CALIBRATED PIPE SCALE: Built-in scale permits speedy adjustment to pipe size.

RENEWABLE PARTS: All parts are readily obtainable, and easily replaced without special tools; thus prolonging service life indefinitely.

RUST RESISTANT FINISH: Entire wrench is rust resistant — Nut and Jaws have a special electroplated zinc coating.

WALWORTH

valves...fittings...pipe wrenches

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DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

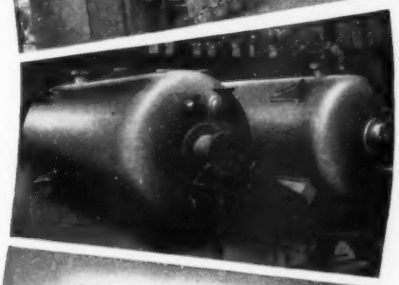
USE THESE BETTER

Vogt Products

For Today's Tough Service Demands

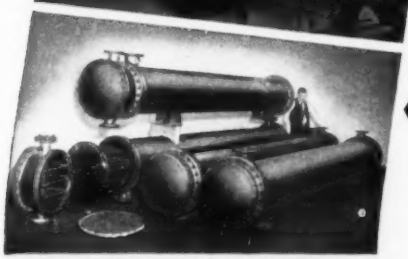
EFFICIENT AND DEPENDABLE STEAM GENERATION

Vogt steam generating units are designed to give maximum rating in a minimum of space with high efficiency and low maintenance expense. Bent tube types and straight tube, forged steel sectional header types to burn solid, liquid or gaseous fuels, as desired, meet every power, heating or process requirement.



PROCESS EQUIPMENT FOR EVERY SERVICE

Stills, towers, oil chilling machines, filter presses, heat exchangers, etc. are constructed to all Codes. They meet all demands for operating security and trouble-free performance and help to lower costs in important process industries around the world.



SPECIAL MATERIALS FIGHT CORROSION AND PRODUCT CONTAMINATION

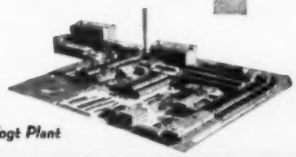
Our modern shops produce a wide variety of equipment made from special metals and alloys to combat corrosion, and product contamination or discoloration. Fabrication procedures employed insure that corrosion resistant properties of welds will match that of the materials from which units are constructed.

MORE TONNAGE AT LESS COST

Over 60 years of manufacturing experience, engineering and research stand behind Vogt refrigerating and ice making machinery. Absorption Systems, Compression Systems, and the Automatic Tube-Ice Machine in a wide range of capacities serve in leading petroleum refineries, chemical plants, ice and cold storage plants, dairies, packing plants, etc., at home and abroad.

DROP FORGED FOR EXTRA TOUGHNESS AND LONG-TIME SERVICE

Vogt valves, fittings and flanges, for top performance in oil, water, air, gas, and ammonia services, at high or low pressures and temperatures, are available drop forged entirely from carbon steel or stainless steel. Valves can be furnished in a combination of materials by using stainless steel for parts affected by service temperature or corrosion, and less expensive alloys or carbon steel for other parts.



Air View of Vogt Plant

HENRY VOGT MACHINE CO.

LOUISVILLE 10, KENTUCKY

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS

ALDRICH WAS FIRST!

to produce high speed pumps with crankshaft speed of 120 rpm (1918)

to develop porcelain plungers

to develop the Variable Stroke Triplex Pump (1926)

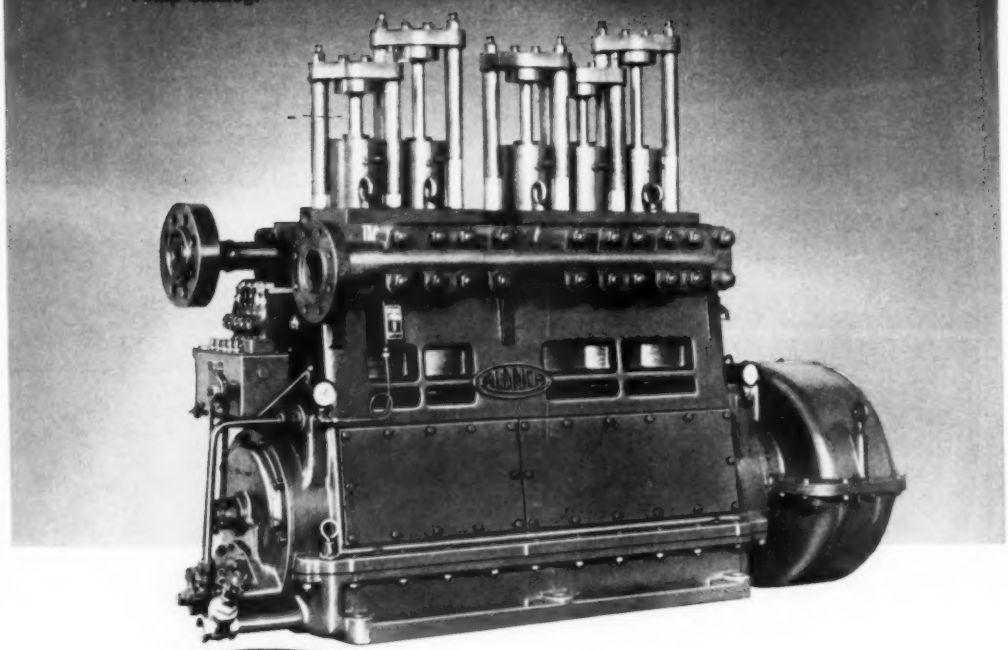
to build 5, 7, and 9-plunger pump units

to perfect the Aldrich-Geoff "Power-Saver" Controllable Capacity Pump (1939)

to advance crankshaft speeds to 225 rpm (1939)

and (1945) to design and produce the Direct Flow Pump: a pump with a "straight line" fluid-end, of sectionalized construction . . . available in the following stroke sizes: 3" at 500 rpm, 5" at 360 rpm, and 8" at 300 rpm . . . applicable for water flooding, water disposal, pumping lean oil to absorbers, and the handling of diethylene glycol, gasoline, propane, butane.

Today—to bring your files up-to-date—request the Aldrich Direct Flow Pump Catalog.



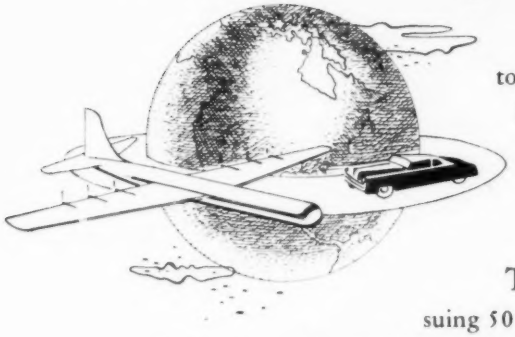
THE ALDRICH PUMP COMPANY

9 GORDON STREET • ALLENTOWN, PENNSYLVANIA

...Originators of the Direct Flow Pump

Representatives: P. H. Arden, P. O. Box 185, Glenview, Ill. • Bushnell Controls & Equipment Co., 3929 W. Jefferson Blvd., Los Angeles 16, Calif. • L. T. Gibbs, 509 Petroleum Bldg., Tulsa 3, Okla. • R. B. Moore Supply Co., Inc., Bolivar, N. Y. • Power Specialty Co., 2000 Kipling St., Houston 6, Texas • Reeves & Skinner Machinery Co., 2211 Olive St., St. Louis 3, Mo. Stearns-Roger Manufacturing Co., 1720 California St., Denver 2, Colo. • Export Sales: Petroleum Machinery Corp., 30 Rockefeller Plaza, New York 20, N. Y. • Birmingham • Boston Buffalo • Cincinnati • Cleveland • Detroit • Duluth • Jacksonville • Omaha • Philadelphia • Pittsburgh • Portland, Ore. • Richmond, Va. • San Francisco • Seattle • Spokane, Wash. • Syracuse

50 Years
that changed the world!



The petroleum industry we know today had its beginning on a January day in 1901, when the discovery well at Spindletop, near Beaumont, Texas, proved the availability of oil in abundant quantities.

The progress of the industry in the ensuing 50 years has had a profound effect upon the way we live: the availability of such an efficient and abundant source of energy has wrought changes throughout the world. The rapid development of the internal combustion engine, the automobile, the airplane, the diesel electric train, the four-day Atlantic crossing, all followed and were in a large measure made possible by the development of the petroleum industry.

Oil fueled the Allied fleets that moved victorious cargoes of World War I; oil provided the gasoline that powered Allied airplanes to victory in World War II; and now, at its Golden Anniversary, the oil industry is better prepared than ever before in history to serve the country's needs.

In peace, in war, in times tranquil or turbulent, the petroleum industry has moved steadily forward; it has blazed the trail for much of our modern industrial development; and it is today more vigorous than in the best years of its youth.

HUMBLE OIL & REFINING COMPANY

HUMBLE

How TIMKEN® bearings help you find it, drill it, pump it, pipe it

TIMKEN bearings are used in virtually every type of oil field equipment—from the portable rigs that drill cores to the machines that lay pipelines.

Typical oil field machinery using Timken® bearings is shown below: portable rig; draw works; pumping unit and tractor with side booms. Other types of oil field machinery equipped with Timken bearings include slush pumps, crown blocks, travelling blocks, engines, rotary tables, swivels, feed controls, valves and brakes.

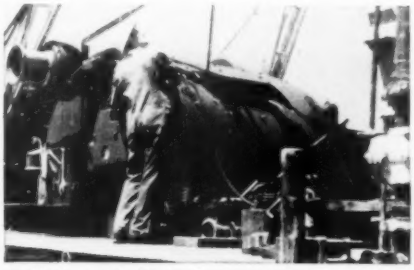
Timken tapered roller bearings are first choice for operators of oil field equipment — and for good reason. Timken bearings hold gears and shafts in proper alignment. Equipment operates with minimum friction. Excessive wear is eliminated. Lubrication time is reduced because Timken bearings permit tight, lubricant-retaining closures that keep out damaging dirt and moisture. Maintenance time is cut to a minimum.

Timken bearings have extra load-carrying capacity because of the line contact between rollers and races. Tapered design enables them to carry any combination of radial and thrust loads. And Timken bearings normally last the life of the machine because they are 1) engineered for the job, 2) made of Timken fine alloy steel, and 3) precision manufactured.

Be sure the bearings, in the machines you buy or build, carry the trade-mark "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

This portable drilling rig has Timken bearings on hydraulic yoke, slush pump eccentric shaft, and on pinion and table of both heavy duty and standard rotary gear boxes.



In this draw works, Timken bearings are used on the fixed position of the main drum and on the sand reel.

Crankshaft of the engine driving this pumping unit, as well as the low speed shaft in the gearbox, is mounted on Timken bearings.

Pipe laying unit shown here is equipped with Timken bearings on the bevel gear shaft, sprocket shafts, and idler pinions.

DESIGN LEADERSHIP

The first Timken tapered roller bearing was produced in 1898. Since then the one-piece multiple perforated cage, wide area contact between roll ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

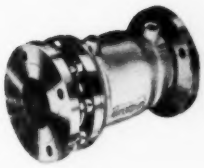
NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ▯ AND THRUST ▯ LOADS OR ANY COMBINATION ▯

IN THE CONTROL OF . . .

AIR . . . . . GAS . . . . . LIQUIDS

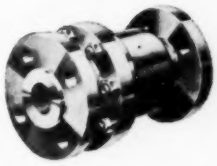
GROVE takes the new approach to old problems

Since its inception, Grove Regulator Company has pursued the course of developing new and better means of solving old problems. Research, a basic and essential part of this long range program, has been directed by practical field experience. The rapid strides of Grove in the sphere of fluid control reflect the tested and proved principles embodied in Grove products. Typical of such outstanding Grove developments are those shown.



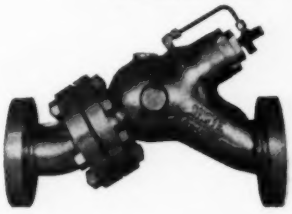
FLEXFLO

Expansible tube type valve for cold fluid services, handles oil, water, solutions, gases and air. Corrosion and erosion resistant Self-operating by various remote control combinations.



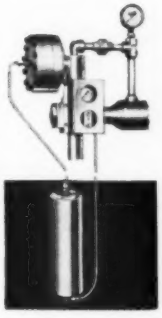
CHEXFLO

Fully self-contained, self-operating check valve, closes on balanced flow prior to the start of return flow. Ideal for handling corrosive fluids or gases. Bubble-tight shut-off, no metallic moving parts.



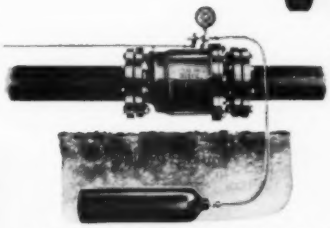
SERIES "S"
FULLSTREAM CHECK VALVE

For high pressure services on compressor discharge or flow lines. Streamlined design gives minimum pressure drop. The valve piston closes with a cushioning effect, so there is no clattering or pounding action to cause wear and shorten life.



MODEL PB-300
REGULATOR

For severe services, as a back pressure or pressure reducing regulator, stands up to toughest conditions. Working parts protected from gas blast, resists freezing or sand cutting. Handles pressures up to 6000 lbs. reducing, 3000 lbs. back pressure service.

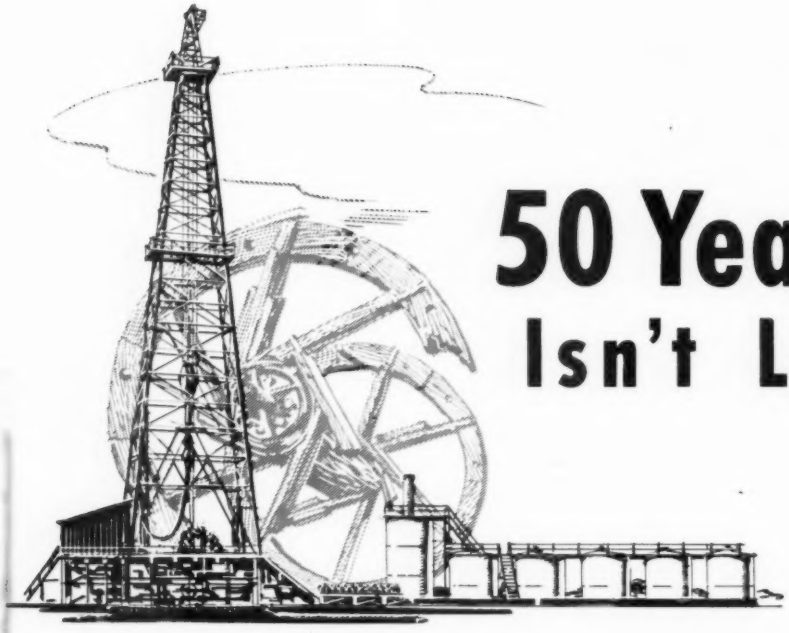


MODEL 888 PRESSURE LOADED RELIEVER

Instant response to slightest variation in line pressure, opens and closes smoothly with no sticking, chattering, leakage or failure. Equally suitable as Back Pressure Regulator opening on constant or intermittent flow.

GROVE REGULATOR COMPANY *65th & Hollis Street, Oakland 8, California*
1901 Calumet, Houston 4, Texas 1930 W. Olympic Blvd., Los Angeles 6, California

GROVE GROVE SIMPLICITY ACCURACY SAFETY *Pressure and Flow Control* SYSTEMS & EQUIPMENT



50 Years Isn't Long!

1951 marks the semi-centennial of the Houston Oil Company of Texas. Established only six months after the Spindletop, discovery, Houston Oil Company has lived through, has grown up with the development of the Texas oil industry.

In its memories are pictures of those earliest days, when wells so crowded each other at Spindletop that you could almost walk through the field by stepping from one derrick floor to the next. And Houston Oil's "old-timers" remember the booms of yesteryear — the quick pay-off and the equally quick transitions from gusher to pumper to exhausted reservoir.

Fifty years isn't long — it's two decades less than man's Biblical span. But how far the oil industry has progressed in so short a time! Hunches, surface seepages, and the divining rod have yielded to scientifically precise methods of exploration. Drilling nowadays is an operation that can be as carefully controlled, almost, as the construction of a building. Production is no longer the rip-roaring, quick money-maker it used to be; it takes the long-range view, regulates the flow of oil to the capacity of the reservoir, and thereby recovers as much as four times the oil the "gushers" produced. Natural gas, which once flared against the Texas sky, now supplies valuable by-products to refiners and chemical plants, and later becomes a fuel to fire the boilers of Texas' industrial development. And the refiners have their own tale of marvels, too long for telling here.

As it nears the completion of its 50th year, Houston Oil looks back, occasionally, on the "good old days" with the affection men and institutions have for memories. But its face is set toward the future; the accomplishments of the oil industry in the past half-century may be only guide-posts to the progress that lies ahead.

HOUSTON OIL COMPANY of Texas

Oil industry progress paralleled by Stockham

Founded two years after the discovery of Spindletop, the Stockham company's growth reflects that of the oil industry it serves. Today Stockham Valves and Fittings are internationally known and used in petroleum production, refining and distribution.

STOCKHAM

VALVES AND FITTINGS

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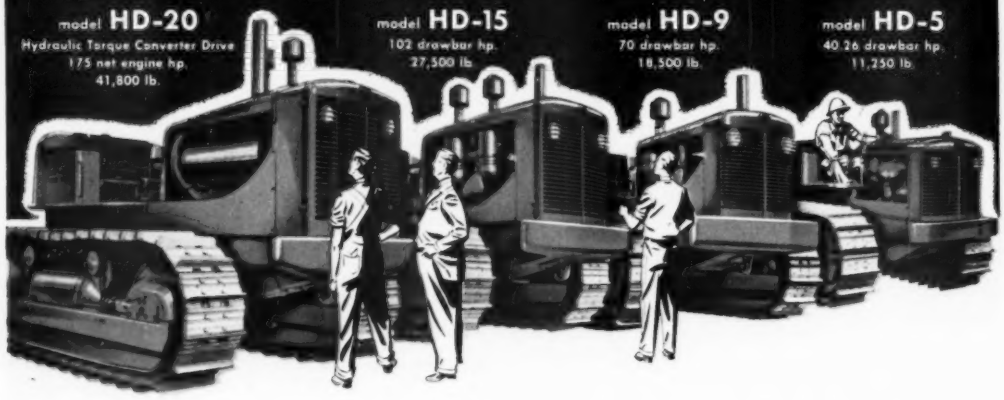
BRONZE VALVES • IRON BODY VALVES • MALLEABLE AND CAST IRON FITTINGS

ALLIS-CHALMERS
Sets New Standards

for Tractor Performance
for Lasting Durability
for Simplified Servicing
for Ease of Operation

. . . THE NEWEST, FINEST TRACTOR LINE ON EARTH



Get the full story from your Allis-Chalmers dealer.
See these tractors perform. They're built for YOUR job!

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Originator of the Torque Converter Tractor

SPRING-MATIC LOADERS are meeting the high expectations of the industry — and are generously praised for their superiority in performance!

OILCO

NO. 460

Interchangeable with counter weights when specified

Sizes
3" & 4"

Pipe length: 7' from center of swing joint to center of end joint; 2' from center of valve to center of swing joint. Drop tube, 2'. Overall length 9', or any length desired.

THIS modernized, long-needed assembly is raised by two compression springs, allowing the loader to return to upright position. The springs are adjustable at top of cam, and are enclosed in hydraulically designed cylinders which control the upward motion of the loading arm. The vertically travel arc is 130 degrees. Smooth, free movement is a feature.

Springs and cylinders are protected with synthetic rubber bellows to prevent water or foreign matter from entering the cylinders. As a safety factor each chain is guarded with an aluminum shield. Compactness is another feature—the Spring-Matic occupies less space on the loading rack.

Note These Other New Features

The ratchet attachment holds the Spring-Matic in fixed position in usage. The chain releases the ratchet.

The cam on which the chain rides is devised to permit spring tension to equalize when the loader is in position.

The inclusion of grounding brushes eliminates sparks and static, ever providing complete contact. No added ground wire is necessary.

Each joint is complemented with a grease retaining ring inserted between five rings of special gasoline packing. The Alemite fittings form a positive seal, simultaneously lubricating the packing.

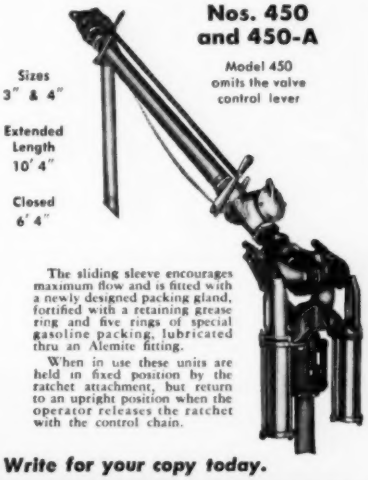
THE Oilco Spring-Matic assembly illustrated below, serving models 450 and 450-A, may be regulated so that the sliding sleeve can be returned to a vertical or semi-vertical position, thereby permitting loading from either side of a rack.

The loader is equipped with Model 462 Sliding Sleeve Assembly, including a swing joint which allows the dip tube to hang in vertical position when not employed.

The swing joint, at the end of the sliding sleeve, has a handle which permits smooth, easy movement of the sleeve.

Nos. 450 and 450-A

Model 450 omits the valve control lever



Sizes
3" & 4"

Extended Length
10' 4"

Closed
6' 4"

The sliding sleeve encourages maximum flow and is fitted with a newly designed packing gland, fortified with a retaining grease ring and five rings of special gasoline packing, lubricated thru an Alemite fitting.

When in use these units are held in fixed position by the ratchet attachment, but return to an upright position when the operator releases the ratchet with the control chain.

Additional details in the New Oilco Catalog, No. 600. Write for your copy today.

OIL EQUIPMENT MANUFACTURING CO.
INCORPORATED
3100 VERMONT AVE., LOUISVILLE 11, KY.
Canadian Affiliate: Empire Brass Mfg. Co., Ltd., London, Ontario

OIL
THE YARDSTICK
OF
AMERICAN PROGRESS

EVER SINCE THE DAY, NINETY-TWO YEARS AGO, WHEN THE DISCOVERY OF OIL TOOK AMERICA OUT OF THE CANDLELIGHT OF ECONOMIC LETHARGY AND INTO THE KEROSENE AND GASOLINE ERAS OF DYNAMIC EXPANSION, THE ADVANCEMENT OF AMERICAN LIVING STANDARDS HAS BEEN IN DIRECT RATIO TO THE INCREASE IN OIL PRODUCTION.

OIL POWERS AND LUBRICATES THE ECONOMIC MACHINE, WHICH HAS PRODUCED MORE OF THE GOOD THINGS OF LIFE FOR MORE PEOPLE THAN ANY OTHER SYSTEM IN THE HISTORY OF THE WORLD.

OIL IN TREMENDOUS QUANTITIES IS INDISPENSABLE TO THE MAINTENANCE AND CONTINUED ELEVATION OF AMERICAN LIVING STANDARDS. IT IS EQUALLY INDISPENSABLE TO OUR NATIONAL SECURITY AND DEFENSE.

PLYMOUTH OIL COMPANY IS PROUD OF ITS IDENTIFICATION WITH AN INDUSTRY THAT HAS MADE SUCH A REMARKABLE CONTRIBUTION TO THE STRENGTH AND GREATNESS OF OUR COUNTRY.

PLYMOUTH OIL COMPANY

WALTER S. HALLANAN
President

THE BLUE NEON DERRICK

Symbol of Service and Supply!

Wherever there is OIL!

Under the blue neon derrick that tops every Mid-Continent Supply Store throughout the oil country, you find men with the "know-how" to give you fast, complete service . . . to solve any and every equipment problem. You'll find a complete stock of the finest equipment and supplies, carrying the brand names that you've learned to trust for their reliability and dependability.

Make the Mid-Continent Supply Store, marked by the famous blue neon oil-spouting derrick, your supply and equipment headquarters.

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*SAN ANGELO, TEXAS
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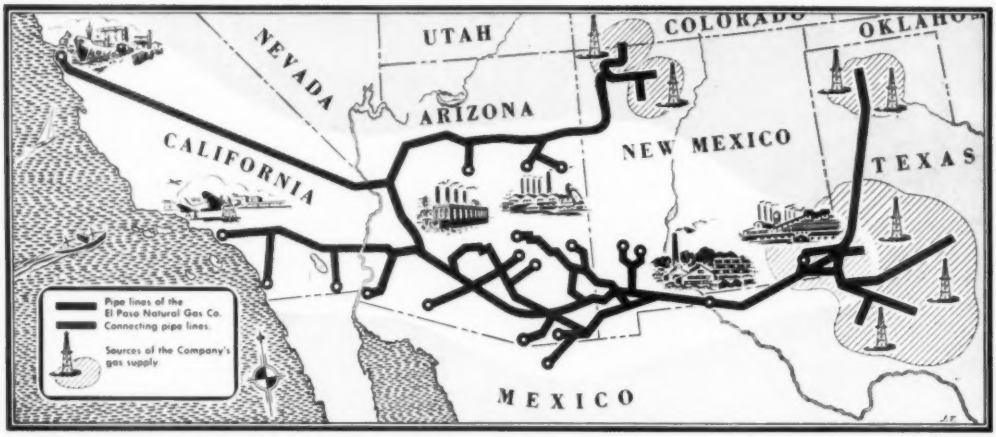
THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

Natural GAS is *the* Fuel

in one of America's Important Industrial Areas



HIGHLIGHTED on the map is an area which has developed more rapidly in recent years than any comparable region in the United States. Its population has increased 40% in the past decade, compared to the 11% national increase. This area delivers 50% of the nation's copper production, 95% of its potash and 15% to 30% of other products important to the national economy, ranging from food and clothing to airplanes, automobiles and heavy machinery.

Within this great empire, natural gas supplies more energy than all other fuels and sources of power combined. Gas is THE fuel for mines, smelters, mills and factories, for smaller businesses and shops, for homes and schools and churches.

El Paso Natural Gas Company plays a vital role in maintaining a constant and adequate supply of essential fuel for this vast area. Operating more than 2,500 miles of 24 to 31 inch diameter transmission lines, and over 3,200 miles of gathering and lateral lines, it delivers more than a billion cubic feet of gas a day. The Company provides all natural gas consumed in Arizona and a major part of that used in New Mexico and West Texas, and furnishes to distribution companies serving California nearly 50% of the gas used in that state.

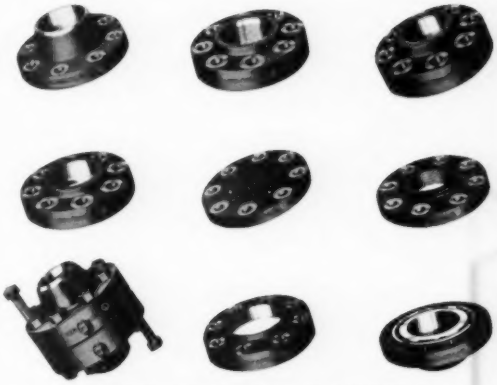
Of all the natural gas delivered by this Company in 1950, over 73% was residue gas. Present expansion plans of the Company, when completed, will enable this firm to deliver not only substantially larger quantities of gas to meet the growing needs of the important international, six-state market it serves, but to increase its unusually high percentage of residue gas. This constitutes a very substantial contribution to the conservation of the nation's natural resources.

El Paso Natural Gas Company

The Pipe Line Company

LADISH *Controlled Quality* LINE OFFERS COMPLETE SELECTION

SEAMLESS WELDING FITTINGS
½-inch through 36 inches
Standard through Double Extra Strong



FORGED STEEL FLANGES
½-inch through 30 inches
150 lbs. through 2500 lbs. pressure

FORGED STEEL FITTINGS
Screwed and Socket Welding
⅛-inch through 4 inches
2000 lbs. through 6000 lbs. pressure

TO MARK PROGRESS

LONG WELDING NECKS
1-inch through 24 inches

LARGE O.D. FLANGES
26 inches through 96 inches

Whatever the piping job . . . Ladish is prepared to supply your fittings needs. Here is the one line that offers them all . . . Seamless Welding Fittings, Forged Steel Flanges, Forged Steel Fittings, Large O. D. Flanges and Long Welding Necks . . . in an unrestricted selection of types, sizes, weights, pressure ratings and materials. Standardizing on this complete line not only simplifies procurement but also assures you of added dependability by protecting every joint of the system through use of Ladish Controlled Quality Fittings.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City

AVAILABLE IN CARBON, ALLOY AND STAINLESS STEELS, ALUMINUM AND OTHER NON-FERROUS METALS

AMERICAN...

partner of Oil for 32 years!

FOR 32 of the 50 years since Spindletop, *American* has *specialized* in the design and production of roller bearings engineered for the gruelling duties of the oil country.

That's why probably more *Americans* go into the crown and traveling blocks, swivels, rotaries, slush pumps, draw works, transmission equipment, and compounding units of the industry than any others. As the industry grew and the demands for increasingly better roller bearings developed, *American* met or anticipated the need. Today *American* equipped rigs are operating in every oil field in the world.

You can *depend* on *Americans.* Engineers, who are as "at home" on a derrick floor as they are in their own office, design them. Craftsmen who understand the exacting standards of the oil industry produce them. Metals for them are selected with the knowledge that hundreds of thousands of dollars ride on their successful performance. In short *Americans* are made for *you!*

In addition to a wide range of standard types and sizes, American Roller Bearings are custom made to your specifications. Send us your blueprints for quotations and recommendations.

AMERICAN ROLLER BEARINGS HEAVY DUTY

AMERICAN ROLLER BEARING CO.

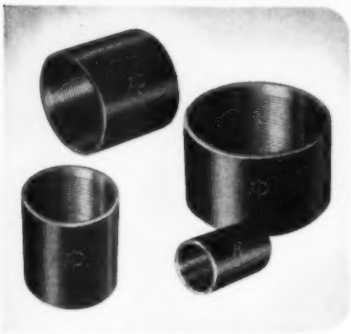
416-420 MELWOOD AVENUE • PITTSBURGH 13, PA.

Pacific Coast Office: Edward D. Maltby Co., 1718 S. Flower St., Los Angeles, Cal.

We are proud of the part we have played in making PETROLEUM THIS NATION'S MAJOR SOURCE OF ENERGY

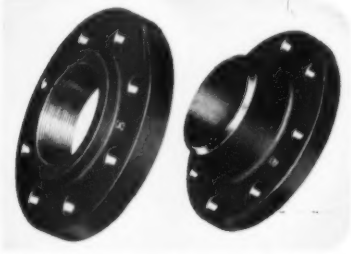
SEABOARD OIL COMPANY OF DELAWARE

Harrisburg SEAMLESS STEEL PIPE COUPLINGS DROP-FORGED STEEL PIPE FLANGES



HARRISBURG Seamless Steel Pipe Couplings are made to A.P.I. specifications.

THE AMAZING thread accuracy of Harrisburg Couplings is one reason why they are preferred throughout the petroleum industry. They are threaded on special machines, assuring accuracy of form, height, angle, and lead. The electro-galvanized threads will not gall under severest strains. Millions are in use in all branches of the petroleum industry, at home and abroad.



HARRISBURG Drop-Forged Steel Pipe Flanges are made to A.S.A. standards.

THE TREND to higher pressures and temperatures consistent with safety and durability is evidenced in modern design of power piping for the petroleum industry. Harrisburg has kept pace by drop-forging Pipe Flanges to exacting standards, then accurately machining under constant inspection to insure a product that will meet the most critical standards demanded by engineers everywhere.

Proved by Performance... where Performance Counts

HARRISBURG MANUFACTURES ALL TYPES

of Seamless Steel Pipe Couplings and Drop-Forged Steel Pipe Flanges—for use in producing wells, treating and separation plants, crude stabilization, gas dehydration plants, desulfurization plants, special products operations, gasoline and LP gas plants, cycling plants, pressure maintenance, gathering systems, pipeline stations, field laboratories, and research operations.

SEE OUR CATALOG IN THE COMPOSITE CATALOG

WRITE for latest Harrisburg catalogs on Couplings and Flanges.

HARRISBURG STEEL CORPORATION

Harrisburg 12, Pennsylvania

Custom-Built Quality Products in Quantity

98 YEARS IN PENNSYLVANIA'S CAPITAL

SPINDLETOP

1901 – 1951

Spindletop was the beginning of many Gulf Coast developments in petroleum. The true significance of Spindletop, however, was not confined to any one area — at Spindletop, oil became an industry.

In another Gulf Coast field, not long after Spindletop, William S. Barnickel successfully treated an oil-field emulsion with chemicals. Continuing this work, he went on to develop effective reagents expressly designed to combat the losses caused by emulsified production. *He named these reagents*

TRET·O·LITE

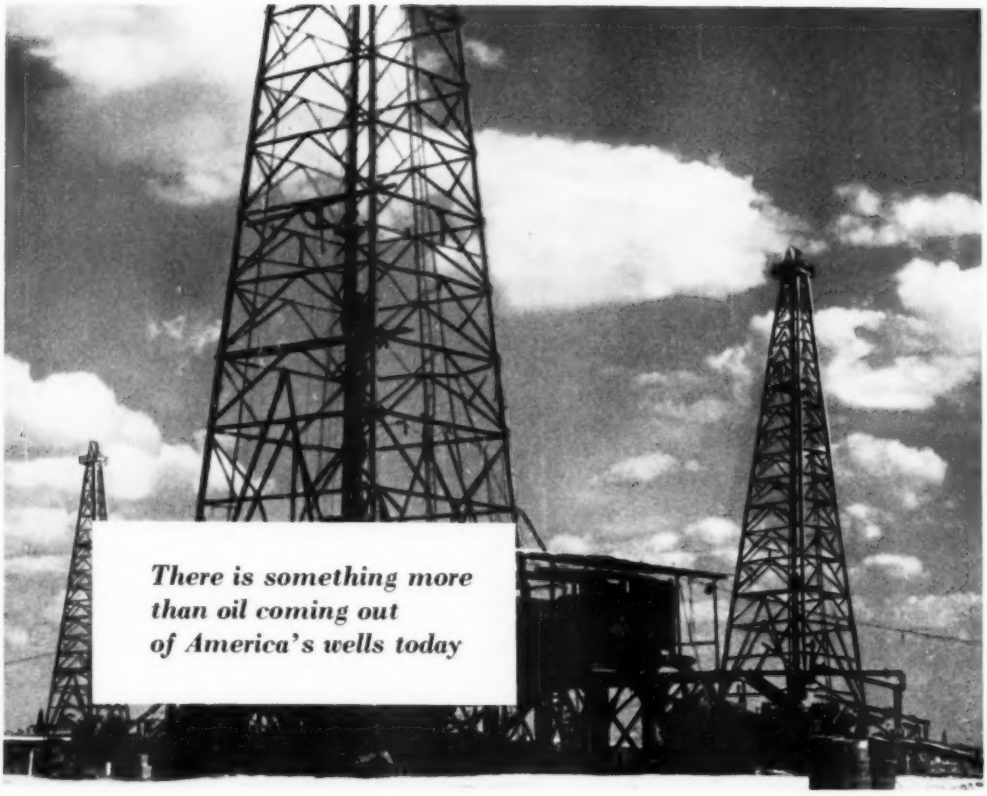
From this pioneer Gulf Coast beginning, the Tretolite Company has progressed to its present position of recognized leadership. A recognition earned through services provided, results produced.

TRETOLITE COMPANY

Chemicals for the Petroleum Industry

SAINT LOUIS 19, MISSOURI
LOS ANGELES 22, CALIFORNIA

DEHYDRATING • DESALTING • CORROSION INHIBITION
WATER DE-OILING • SCALE PREVENTION • PARAFFIN REMOVAL



It is CONFIDENCE

It is confidence that the Petroleum Industry is able to supply the basic needs of the world's strongest nation in the event of any emergency.

It is confidence that the whole Industry has kept faith with an ideal that has made America strong . . . the ideal of Progress.

The Ohio Oil Company is proud to be an important part of the Industry . . . glad to take this opportunity to congratulate both Southwestern Oil and The Oil and Gas Journal on their half-century of progress since Spindletop.

The OHIO OIL COMPANY
Producers of Petroleum since 1887

BEST IN THE LONG RUN
MARATHON

a *Salute* to HARLEY SALES COMPANY Pioneers in the Introduction and Distribution of *Air-Cooled* Engine Power for OIL FIELD SERVICE!

ROY O. NEAL, General Manager. His 35 years of concentrated experience in the oil industry includes: Chief Chemist for a major oil company; Petroleum Engineer for U. S. Bureau of Mines; Consultant Engineer for several large concerns; actual experience as oil producer. Has two engineering degrees.

HARRY B. NEAL, Secretary-Treas. Born in Ohio and has followed oil and gas industries from Ohio through Indiana, Kansas and to Oklahoma. Familiar with all phases of oil industry, including refining and manufacture of gasoline.

BOB R. NEAL, Chief Engineer. Graduate mechanical engineer with special engineering training after the war at Cambridge (England). Born in Tulsa and has wide acquaintance throughout oil field territory. First experience with WISCONSIN ENGINES dates to summer school vacations at the inception of Harley Sales Co.

GEORGE E. KLUPPEL, Houston Branch Manager. Graduate of Rice Institute where he taught engineering. Sold first air-cooled engine to be used in the oil industry in Texas. In charge of Harley Houston store practically ever since it opened. Thoroughly familiar with the oil industry and the individual problems encountered in Texas and Louisiana.

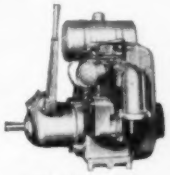
Meet the men and the organization responsible not only for the introduction of air-cooled engine power to oil field operations, but also for the most effective utilization of many kinds of pumping, compressor and electrical units and other auxiliary equipment designed to fit the individual requirements and problems of oil field operators.

The outstanding success of the Harley Sales Company as dominant distributors of Wisconsin Air-Cooled Engines and related power-driven equipment, can be credited to these important basic factors:

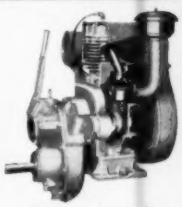
1. Many years of concentrated experience in the petroleum industry and thorough familiarity with all phases of the customers' physical problems, the psychology of oil field operators and the economics involved.
2. Field testing of equipment under actual operating conditions. Accurate service records determine the advantages and limitations of units on test, providing the customer with ultra-conservative performance claims. He knows what to expect and usually his expectations are more than fulfilled.
3. Full recognition of the need for prompt delivery of oil field units and parts . . . backed by exceptionally large warehouse stocks. *All orders for parts must be handled the same day they are received.*
4. Recognition of the extreme dependability and adaptability of WISCONSIN HEAVY-DUTY AIR-COOLED ENGINES for oil field service and 100% standardization on this line . . . reflected in the fact that Harley Sales Company is today the world's foremost distributor of Wisconsin Engines.

Not only was the Harley Sales Company the FIRST to introduce Heavy-Duty Air-Cooled Engines to the oil industry, but this organization is also credited with being the first to present light weight, portable oil field utility units where higher speeds compensated for the heavy massiveness of slow-motion units.

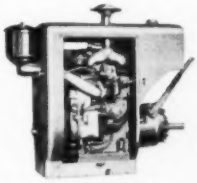
The Wisconsin Motor Corporation is proud to offer this highly deserved salute to an outstanding organization whose men and equipment match the critical demands of oil field service.



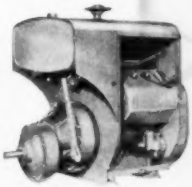
4-cycle single cylinder Models ABN, AKN, 3 to 6 hp.



4-cycle single cylinder Models AFH, AGH, AHH, 6 to 9 hp.



Two-cylinder Models TE, TF, 7 to 13 hp.



V-type 4-cylinder Models VE4, VF4, VP4D, 15 to 30 hp.

All Wisconsin Air-Cooled Engines have self-cleaning tapered roller bearings at both ends of the crankshaft and are equipped with outside-mounted rotary type high tension magneto with impulse coupling (can be serviced or replaced in a few minutes). Special heads and valves can be provided for all models when natural gas of varying heat value is used for fuel.

WISCONSIN MOTOR
Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
619 S. MAIN STREET, TULSA, OKLAHOMA
M & M BUILDING, HOUSTON, TEXAS
505 SOUTH MAIN ST., WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS

oil well tubing to satisfy the nation's thirst for oil

ELECTRIC WELD NORMALIZED TUBING

While the oil producing industry has been growing in stature and in service to the nation, the steel pipe industry has paralleled it in growth. Republic, one of the oldest and largest steel pipe producers, has been an important factor in this development.

Republic pioneered the Electric Resistance Welding Process which converts close-tolerance, flat-rolled steel – both sides of which are open to inspection – into tubular products of uniform wall thickness, diameter and concentricity. Republic introduced full normalizing which gives casing and tubing a uniform refined grain structure, with uniform hardness around the entire circumference.

ALMOST A QUARTER-CENTURY OF SERVICE TO THE OIL AND GAS INDUSTRY

REPUBLIC

ELECTRIC WELD TUBULAR PRODUCTS

REPUBLIC STEEL CORPORATION

GENERAL OFFICES • CLEVELAND 1, OHIO

Export Dept. Chrysler Bldg., New York 17, N. Y.

REPUBLIC STEEL

ELECTRIC WELD NORMALIZED CASING

. . . made by Republic's improved Electric Resistance Welding Process, it is uniformly round and uniform in wall thickness. Cold formed from high-ductility steel, fully normalized for uniform structure and cold sized to insure accuracy of dimensions and concentricity, it offers extra resistance to severe external pressures. Cold sizing increases yield point and tensile strength without sacrificing ductility. Joints have added pull-out strength because a uniform depth of sound steel is left beneath thread roots at every point. Threads are clean and full-formed. They stab, spin-in and tong-up fast . . . take hold with a bulldog grip. And, it's inspected inside and out. Many millions of feet have served dependably in all fields.

steel strings dipping deep in the quest for oil

clear channel for fast-moving fuels

ELECTRIC RESISTANCE WELDED WELD LINE PIPE

. . . offers the construction and operating advantages of uniform size, roundness, diameter and wall thickness . . . uniform high yield strength . . . uniformly straight, long lengths . . . ease of bending and welding . . . freedom from scale . . . inside and out inspection. The 59,000 miles placed in service over the past two decades–in transmission, distributing, collecting and products lines–prove its dependability.

LARGE DIAMETER ELECTRIC FUSION WELDED PIPE

Republic's most recent contribution to oil and gas industry progress is the production of high pressure line pipe in large diameters, bringing size ranges up through 30-inch OD. Pipe 24-inches and larger is electric fusion welded inside and out, and hydraulically expanded to uniform size, roundness, straightness and circumference. Hydraulic expansion also increases yield strength for safe handling of high pressures. Always-constant circumference and uniform wall thickness help joints line up accurately and quickly so that the entire circumference can be field welded at top speed.

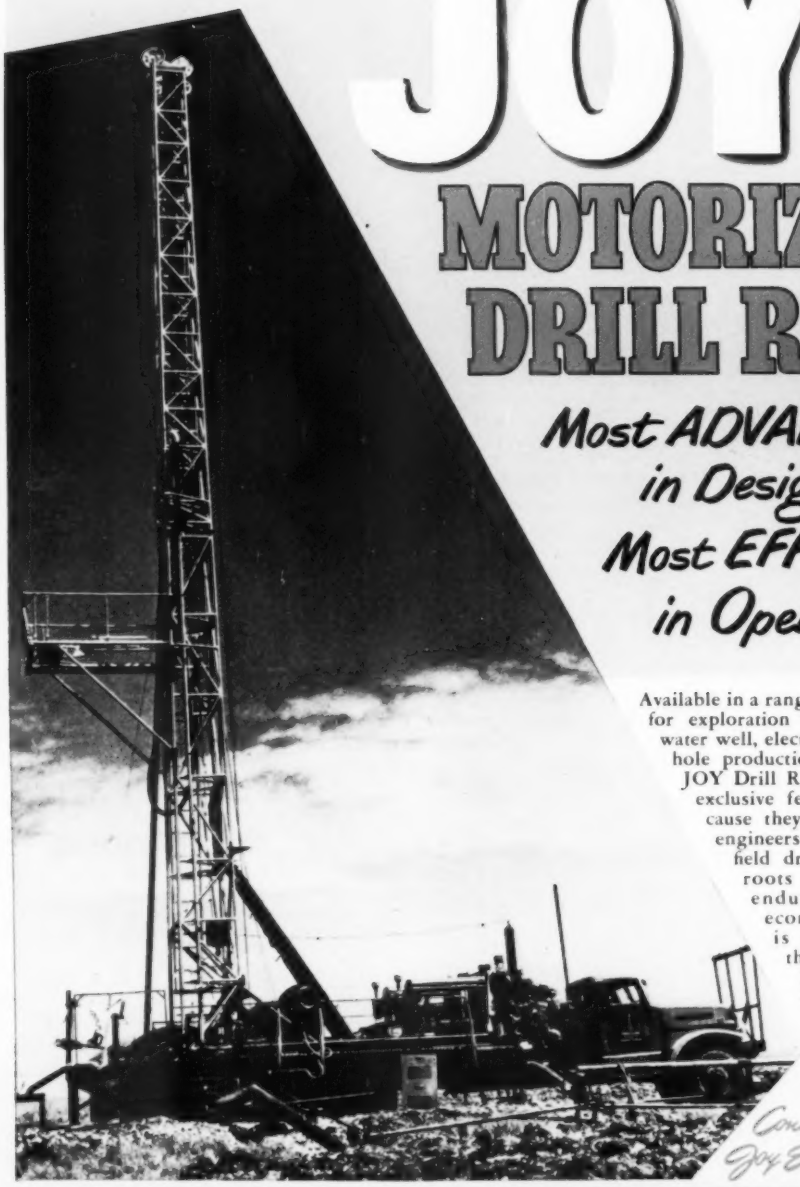
natural gas travels to market through subways of steel

1851-1951 . . . One Hundred Years of Engineering Leadership

JOY

MOTORIZED DRILL RIGS

Most ADVANCED in Design — Most EFFICIENT in Operation!



Available in a range of heavy-duty models for exploration drilling, seismograph, water well, electrical logging or slim-hole production drilling to 5000'. JOY Drill Rigs incorporate many exclusive features you'll like, because they're built by practical engineers—men who know oil-field drilling from the grass roots down. ● For speed, endurance, mobility and economy, your best bet is a JOY rig—built by the world's oldest and largest producer of core drills and motorized drill rigs.

Write for Bulletin, or

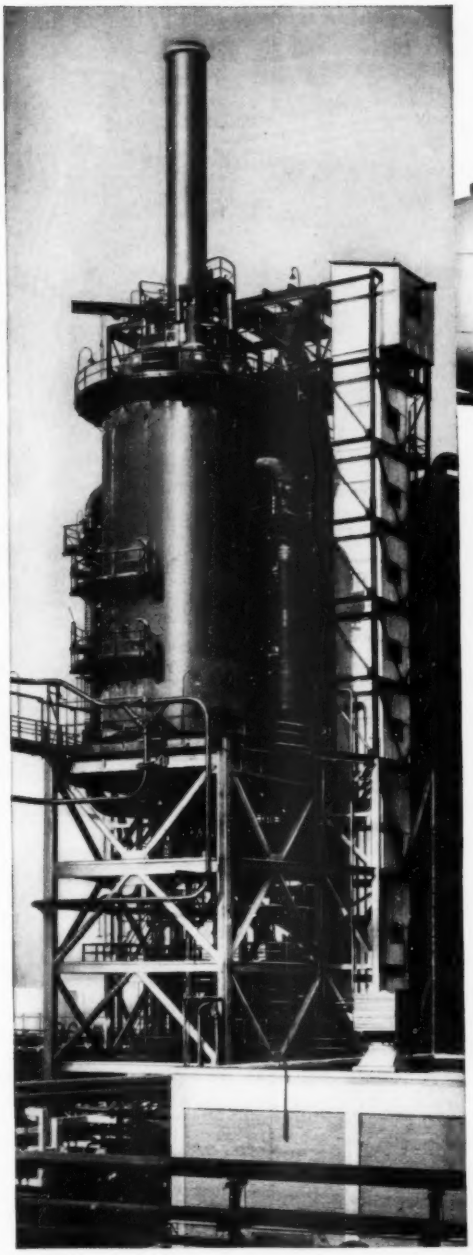
Consult a Joy Engineer

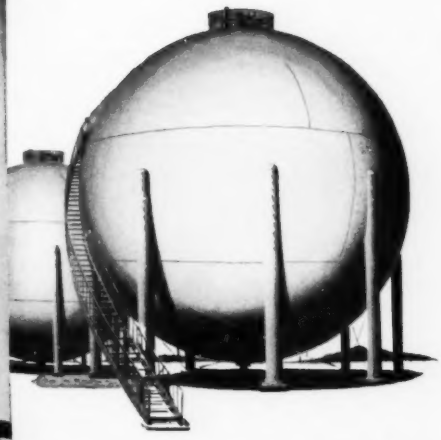
W&D O 3002

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO





. . . again
up steps progress in petroleum

ACTIVITY NO. 1 at Cities Service is to keep right up to *today*.

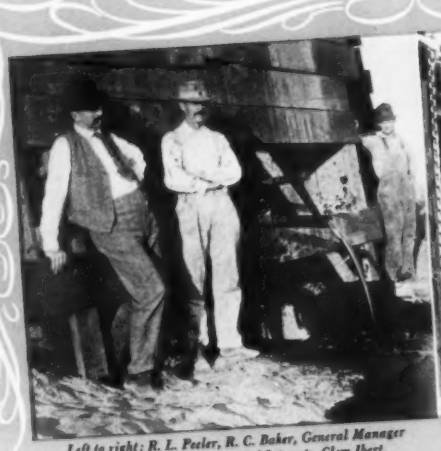
One of the most recent steps of Cities Service progress reaches skyhigh over East Chicago today. The Cities Service refinery there is now topped by a huge new unit of the latest type for catalytic refining. Improvements extend to the refinery's new gasolene treating equipment, gas purification unit, and gas recovery system. Many other modern structures, including the new "spheres" for storage of highly volatile hydrocarbons, all enter into that new look today at East Chicago.

There as elsewhere, progress by Cities Service results in products of excellence, and service to match. Consequently, users of petroleum products for industry, commercial transport, farming, and motoring can be sure of receiving top quality when ordering from Cities Service.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

FROM THE BAKER PHOTO ALBUM



Left to right: R. L. Peeler, R. C. Baker, General Manager and Supt. of W. P. Hammond Interests, Clem Ibert.

Morning tour crew of Coalinga Syndicate Well No. 5A. Left to right: Ribard, Hatfield, Burress.

Pioneering in Early 1900's...

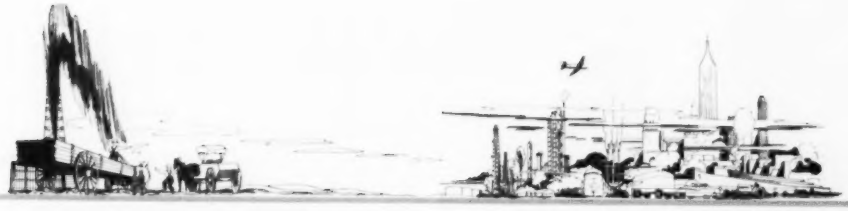
...Baker is still pioneering

R. C. Baker, president and founder of Baker Oil Tools, Inc., gained a wealth of experience in the field as a driller-contractor-operator before he turned to the development and manufacture of oil tools. In addition, he brought with him a true pioneering spirit that has since inspired his entire organization. That's why products bearing the now famous Baker trade mark have, for more than forty years, played a major role in the development of oil-producing territory throughout the world. And that's why the name Baker continues to head the list for BESTS in tools, services, and results wherever men drill for oil. Yes, Baker is still pioneering in making oil tools with a purpose.

BAKER OIL TOOLS, INC.

HOUSTON • LOS ANGELES • NEW YORK

A "life saver" for thousands of wells—Baker Cement Retainer, also used as a Bridge Plug run on electric wire line.



FIFTY YEARS OF PROGRESS

Having been a part of the oil industry about as long as there has been one in the Southwest, the Journal starts its fiftieth year with this history of a half-century of progress.

The chief value of any history, aside from its human interest, is the guidance it provides for the future. In reviewing the history of southwestern oil during the past 50 years, one cannot help but be impressed with the tremendous odds which the pioneers overcame. Today's problems may seem difficult, but surely they cannot be as tough as those of the past.

The old timers had to make an industry out of nothing but their pluck and ingenuity. In the beginning they had little or no knowledge of the occurrence of oil, how to control the forces that produce it, or how to refine it. By trial and error and by one expedient after another they developed a virtual arsenal of equipment and instruments, built up a heritage of scientific knowledge, and won the respect of the public.

Today the great industry they established is following in their footsteps. We may not know all the answers, but from those who went before we have learned how to approach and thus how to solve the problems. There are many opportunities for pioneering and progress in the industry, and the spirit of the old timers points the way.

This volume is a story of men and of methods, but there are so many of both that only a few can even be mentioned. It is presented as a running account of the various branches and activities of the industry in the Southwest, a highlight summary for the operating oil man.

We of the Journal are proud to have been a part of this petroleum growth within the colorful Southwest. We, too, were cradled at Spindletop, and grew with the industry throughout the Southwest and to international stature, sharing the industry's trials and triumphs and guiding its progress to the best of our ability.

This volume was made possible by the cooperation of hundreds who supplied data and pictures. It is impossible here to make individual acknowledgment, but to all we express our appreciation.

Our hope is that we have made a permanent contribution to the historical literature of a great area of a great industry.

P. C. Lauinger

ANTHONY F. LUCAS

PATTILLO HIGGINS

An advertisement inserted in a New York trade journal by Pattillo Higgins enticed Anthony F. Lucas, an Austrian mining engineer, to drill for oil on Spindletop mound. The result was the 75,000-bbl.-daily gusher shown below which blew in on January 10, 1901.

Spindletop—

The Well

A Salt Dome Gains Immortality

SPINDLETOP, named for a spindly pine tree which stood on its summit 4 miles from the center of Beaumont, is a low, flat mound less than 300 acres in extent and rising only 10 or 12 ft. above the surrounding plain.

As early as 1881 gas bubbles were noticed in the swamp at its foot, and a pool of oil which constantly floated on the waters of Sabine Pass, 15 miles from shore, was used by ships as a refuge during storms. During the 1890's three attempts were made to drill for oil at Spindletop, but the cable tools failed in the 500-ft. bed of quicksand which underlay the surface clay.

Pattillo Higgins—The First Believer

Near the end of the century, Pattillo Higgins, son of a pioneer Beaumont family, declared his belief that there was oil under Spindletop mound. Discussing this many years later, Higgins said, "In my early days I began studying about oil and gas manufacturing. I went to Ohio and Pennsylvania and saw them using kerosine for fuel; I was going to establish a brick factory, and it occurred to me that we might get this kind of fuel down our way. When I came home I got a book from the U. S. Geologic Survey. I read the book, and I decided that the theory of that day regarding the geology of the Beaumont area was all wrong. So I began to apply my theory, and I decided there was oil at Spindletop."

Young Higgins "sold" his theory of oil at Spindletop to a number of men with financial means. As a result, Gladys City Oil, Gas & Manufacturing Co. was formed on August 16, 1893, and land was purchased near the mound. The records are not clear on the number of wells drilled by the Gladys City company. However, it drilled at least one well on the

Cradle of the Southwestern Oil Industry

by Leigh S. McCaslin, Jr.

mound in 1893 and abandoned it at a depth of 418 ft.

Higgins still believed in his theory of oil at Spindletop despite failure to find it by drilling. An advertisement inserted by him in a New York trade journal caught the eye of Capt. Anthony F. Lucas, an Austrian mining engineer who had been exploring for minerals in Louisiana for 6 years. Lucas came to Beaumont, and concurred in Higgins' estimate of Spindletop.

GUSHER!—Captain Lucas' Own Story

On June 20, 1899, Lucas leased the Gladys City land, plus enough additional acreage to make a block of 27,000 acres "in order to have ample scope for exploration." Lucas then drilled a well to 575 ft., encountering shows of gas and enough heavy oil to yield a sample. Mechanical difficulties kept him from drilling deeper.

His first well at Spindletop exhausted Lucas' limited capital. With a small bottle containing the sample of oil which he recovered in this initial well, he headed east looking for capital. He was successful in arousing the interest of the pioneering wildcatting firm of

Significance of Spindletop . . .

The gusher which Capt. Anthony F. Lucas brought in near Beaumont January 10, 1901, electrified the world because its initial flow of 75,000 to 100,000 bbl. per day was equal to 50 per cent of the daily average production of the entire United States in 1900.

SPINDLETOP was the country's first large-producing oil well.

- brought the Southwest to the forefront as an oil-producing area.
- was the birthplace of many important oil companies.
- was training ground for many outstanding industry leaders.
- permitted expansion of the market for petroleum products.
- indicated that major oil production is associated with salt domes.
- initiated widespread use of the rotary system of drilling.
- enabled the United States to surpass Russia as the world's leading crude producer.
- saw the birth of The Oil and Gas Journal.

Four teams of horses were required to move a steam boiler through Spindletop field. Horse-drawn transportation enabled the many operators in the field to drill 138 producing wells by the end of 1901.

"There's No Oil at Spindletop"

E L. DeGOLYER, world-famous geologist and a friend of Captain Lucas, says that "Spindletop was not an inviting prospect, according even to the loose standards of the time." His amplification of this remark is interesting.

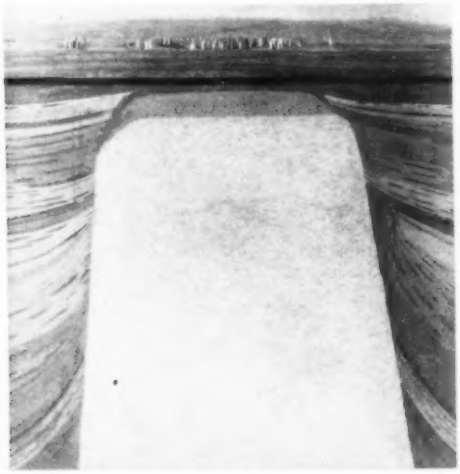
"Corsicana, the nearest commercial pool, averaged 2,300 bbl. daily for 1900, but it lay 200 miles to the northwest. It was some 900 miles from the mound to the first important eastern field and more than 91 per cent of the nation's oil then came from the East. California's field from which there came a little less than 7 per cent of our oil was 1,500 miles to the west. Outside these regions and Texas a few scattered fields were producing a little less than 1 per cent of the nation's 175,000 bbl. daily.

"There were no oil seepages; only the gas escape and slight incrustations of sulfur. There was the mound; so slight as to be hardly recognizable in any land less flat than this. Even it was likely to be misunderstood by the best experts of the time. Only the unwavering faith of Higgins and the Louisiana training and vision of Lucas could give it credit. Foremost experts condemned it.

"My old chief, Dr. C. Willard Hayes, then of the United States Geological Survey, soon to become its chief geologist and afterwards vice president in charge of production for the great Mexican Eagle Oil Co., S. A., visited the mound in the fall of 1899. He could see 'no precedents for expecting to find oil in the great unconsolidated sands and clays of the Coastal Plain.' A few months previously Calvin Payne, production expert for the old Standard Oil Co., had examined the prospect. He had visited the oil fields of Russia, Romania, Borneo, Sumatra, and every oil field in the United States. He thought 'that there was no indication whatever to warrant the expectation of an oil field on the prairies of southeastern Texas.' He condemned the prospect and advised Lucas to abandon it and get back to his profession. It should be noted as evidence on the state of prospecting at the time that both of these outstanding experts emphasized the lack of oil seepages."

Guffey & Galey of Pittsburgh. The Austrian formed a partnership with J. M. Guffey and J. H. Galey known as J. M. Guffey Co. of Beaumont, and the Spindletop leases were renewed.

This new partnership succeeded as is evidenced by the now historic Spindletop gusher. No one could be better qualified to tell the story of this well than Anthony F. Lucas. This he did 6 weeks following the discovery when he addressed a meeting of the Richmond Chapter, American Institute of Mining Engineers.



The salt dome, around which Spindletop production is found, is roughly 1 mile in diameter at its top. This photograph is of a model of the dome prepared by Dr. Donald C. Barton, Humble Oil & Refining Co., for exhibition at the 1936 Dallas Centennial. It is now on exhibition at the Texas Memorial Museum, Austin.

His story of the "bringing in" of the well is a matter of record in the transactions of that society, as follows:

"At first I employed the system of boring which I had previously used in the Louisiana salt deposits. But I soon found that this method was inadequate, without modification, to deal with the quicksand. Accordingly, I adopted the use of large and heavy castings, and pipes of 12, 10, 8, 6, and 4-in. diameter, successively telescoped one into the other.

"Boring was begun by Messrs. Hamill Bros., of Corsicana, contractor, about the middle of October 1900; and on January 10, 1901, after many difficulties, a layer of rock containing marine shells was reached, at the depth of 1,160 ft. For 150 ft. immediately above, the drill had passed through layers of sandstone and concretions of limestone. At this time there was about 600 ft. of 4-in. pipe, weighing at least 6 tons, in the well; and this, together with the next (6-in.) casing above, was filled with water.

"When the rock was penetrated the well 'blew out,' lifting the whole of the 4-in. pipe . . . it went to a height of 300 ft. above the derrick, the upper works and heavy tackle of which it carried away.

"Simultaneously, the water which filled the well was expelled to a great height; and a column of gas, rock fragments, and oil followed it, at first at the rate of about 250 bbl. per hour, rapidly increased to 500, 1,000 bbl., etc., until on the third day of the discharge (by that time carrying no solid matter and a diminished quantity of gas) was estimated . . . to be at least 3,000 42-gal. barrels of oil per hour, or about 75,000 bbl. in 24 hours."

The Boom Is on—As Told by Al Hamill

Al Hamill, contractor on the well, has described the excitement generated by the gusher. His narrative begins just after the oil started going over the top of the derrick in a column more than twice the height of the derrick.

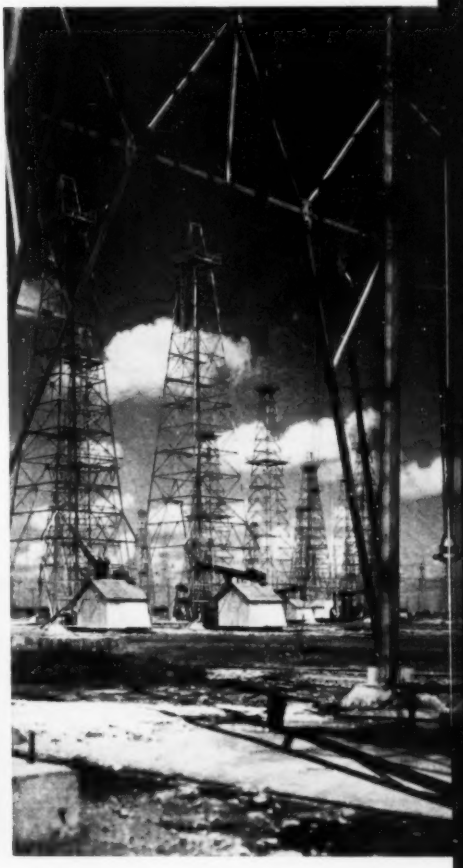
"Farmers who had heard the roar and could see

SPINDLETOP—1902

This view of the Kieth-Ward tract was taken in the early development period of Spindletop. The derricks were so close together, in some cases, that it was possible to walk from derrick floor to derrick floor without touching the ground.

SPINDLETOP—1951

Steel derricks have now replaced many of the wooden structures which were initially used in drilling these flank wells. Over 2,200 wells have been drilled in the 50-year history of the field, but only 150 remain active.



SPINDLETOP—1926

Spindletop experienced a rebirth in this year when Yount-Lee Oil Co. found production on the flank of the Spindletop salt dome. By 1927 the field was producing more oil than in the best year of the initial boom. Note that wooden derricks were still the vogue.

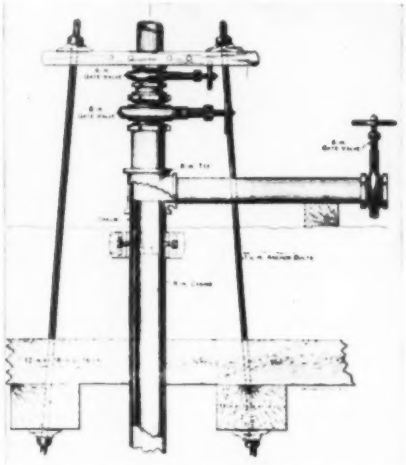
the oil flowing, began to show up. In a very short time people began to come by horseback, buggy, and on foot. Then we began to think of the fire hazard, and at once engaged watchmen from the crowd to see that no smoking be allowed.

"During the night the captain located me and said Mrs. Lucas insisted that he take me home with him so I could get a little sleep and have some breakfast. While we were having breakfast, the first oil men arrived at his house on the way to see the big well. They were J. S. Cullinan, S. M. (Golden Rule) Jones, and T. J. Wood from Corsicana.

"In the meantime, hundreds were arriving, excitement was running high, and propositions were being made to shut in the huge gusher. Some estimates ran as high as $10,000."

Capping the Gusher—Engineering of 1901

The capping of the gusher was an epic engineering feat for the year 1901. In his A.I.M.E.



It was this apparatus that Captain Lucas and the Hamill brothers devised to cap the wild flowing gusher nearly 9 days after the well came in. The drawing is from an A.I.M.E. paper which Lucas presented a few months later.

address, Lucas described the equipment and the procedure used:

"Since this unprecedented outbreak took us by surprise, it was necessary to improvise some means of preventing the total waste of the oil ejected, and at the same time to devise a method for getting the stream under control. To attain the first objective, we hastily constructed dams or levees to surround the oil. The first one, about 2½ ft. high, was overflowed in 24 hours; a second and a third, embracing larger and larger areas, the latter covering about 50 acres, were likewise overflowed.

"I was flooded with telegrams, letters, and personal applications by the hundred from parties proposing to undertake the closing of the well—for large rewards. Some of them required cash down (ranging from $30,000 to $100,000); some would not divulge their proposed methods until paid; others submitted their plans; most of them were cranks, but a few had very sensible ideas. I decided to give the first opportunity to my contractors, Messrs. Hamill Bros., subject to my approval of their plan, which I gave, after suggesting certain modifications.

"The apparatus used consisted of a carriage, anchoring an 8-in. gate valve against upward movement; below the valve a short nipple, with an 8-in. tee attached. The whole apparatus was to be launched against the column of solid oil. This constituted the critical part of the operation. But, since the oil was spouting through a 6-in. pipe, and my main outside casing was 8 in. in diameter, the new 8-in. valve, if successfully placed over and connected with the 8-in. well casing, would permit the stream to go on flowing, with an enlarged diameter (or, in other words, with 1-in. 'play' all around it), so that the flow would not be checked by this part of the operation. The result answered our hopes. Notwithstanding the violent impact of the oil column, the carriage was successfully placed over the well, and the valve, etc., were drawn down with the aid of bolts until the tee could be screwed into the 8-in. casing.

"When this had been accomplished the oil was freely flowing through the open 8-in. gate valve. We then inserted into the tee outlet a piece of 6-in. horizontal pipe, with a 6-in. gate at the end; and after bracing the 8-in. valve as firmly as possible, we gradually closed it, diverting the stream into a horizontal direction and carrying it out of our way. This gave us opportunity to dig

Capt. Anthony F. Lucas

CAPT. ANTHONY F. LUCAS, whose real name was Anthony Luchrich, was born in Spalato, Dalmatia, Austria, the son of a shipbuilder and shipowner. When he was 6 years old his family moved to Trieste, Austria, where he received his primary education. At the age of 20 he graduated from the Polytechnic Institute, at Gratz, and then entered the Naval Academy of Fiume and Pola from which he graduated in 1878.

In 1879 he came to the United States to visit an uncle living in Saginaw, Mich., and became so interested in the lumber business that he resigned from the Austrian Navy, changed his name to Lucas, and applied for American citizenship.

From 1879 to 1893 he engaged first in lumbering, and then as a consulting mechanical engineer in Washington, D. C. In 1893 he accepted a position as mining engineer for a salt-mining company at Petit Anse, La. He spent the next 6 years exploring for minerals in Louisiana.

As the result of an advertisement in a New York trade journal, Lucas was attracted to Beaumont and the Spindletop mound. He leased the ground under Spindletop on June 20, 1899. On January 10, 1901, his famous gusher came in.

The Austrian engineer left Beaumont only a few months after his discovery. In the following year he drilled on the Damon Mound in Brazoria County, Texas, and held leases on High Island near Galveston. Both of these areas have since been proven productive of oil although Lucas was not successful at the time.

In 1902 Captain Lucas went to Mexico in the employ of the Mexican-Eagle Oil Co., Ltd. While there he discovered San Cristobal and Ialtipan fields in southern Mexico. He returned to Washington in 1905 as a consulting engineer, and maintained his residence there until his death September 2, 1921.

around the well, beneath the derrick, and place foundations for an anchorage, which would effectively hold down not only the valves, etc., but also the casings.

"After this we packed oakum tightly between the 8-in. and the 6-in. casing; placed a heavy wrought-iron clamp around the former, and by means of strong set screws secured the 6-in. pipe against any possible upward movement. Finally, by closing the 6-in. gate valve on the horizontal pipe, the flow of oil was entirely cut off. This was done January 19, at 11:10 a.m., nearly 9 days after the well began to flow. The pressure after shutting down, as determined by a gage connected with the tee, was 104 psi.—considerably less than had been inferred from the violence of the stream.

"For further protection against fire, a large iron cylinder was constructed to contain the valves, tee, etc., aboveground, with a surrounding packing of sand, so that a conflagration in the oil pools would not be communicated to the well."

The Formation—Core Analysis in 1901

Lucas was no carefree adventurer interested only in the riches to be gained from a major oil discovery. He was an outstanding mining engineer and scientist. His engineering approach is evident from the information contained in his A.I.M.E. address. A sample of rock fragments which were emitted from the well along with the oil was sent to Prof. Gilbert Van Ingen of Columbia University. Van Ingen gave the following description of the sample, according to Lucas:

"The rock is a compact quartz sandstone, with grains of pellucid quartz, varying from round to crystalline. The fossils are in layers, the oyster shells having been apparently washed into their present position by wave action. The interspaces between the oyster shells are occupied by less compact sand, full of small lamellibranch shells. These are seldom perfect; and, on the whole, the material is so fragmentary that identification of the species is very difficult or impossible. They are clearly Tertiary, but whether Eocene or Miocene, does not clearly appear. The following list comprises all that Professor Van Ingen could make out: Ostraea (sp. ?), very abundant; Turritella (sp. ?), in a fragment; Mactra? (sp. ?), very small, and not positively identified. In addition to these, there was found a fragment of lignitized wood."

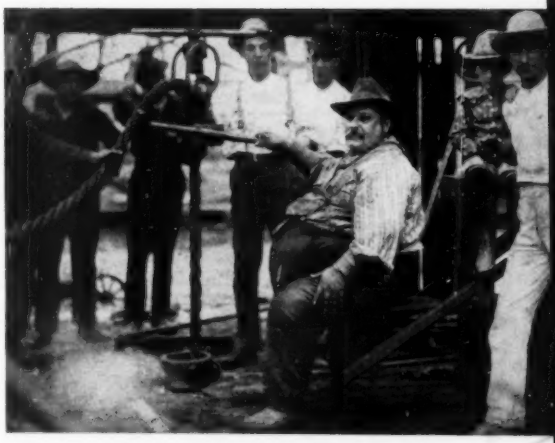
The Oil—Crude Analysis in 1901

Captain Lucas, as well as the entire oil industry of the day, was greatly interested in the composition of the Spindletop crude. Major products from crude oil in 1901 were illuminating oil and fuel oil.

Two analyses of the crude were included by Lucas in his A.I.M.E. talk at Richmond. One of these obtained from the Bradford Daily Record of January 31, 1901, and read, in part, as follows:

"The Beaumont, Tex., oil is of a dark green color and has an offensive odor, similar to that of Lima and Canadian oils, with the odor of sulfureted hydrogen more pronounced.

"The crude oil has a flash test of 110° F. (43.3° C.) and fire test of 180° F. (82.2° C.) gravity at 60° F. (15.5° C.) is 23.6° Baume.



This cable-tool driller was known during the Spindletop boom as "the largest man in the field." His identity has been forgotten by the owner of this rare picture. R. F. Williams, of Edgerly, La.

"The oil showed no evidence of congealing at a temperature of 5° F. below zero (—20° C.); this property denotes the absence of paraffin and belongs to a series of oils having an asphaltum base . . . while the above oil would pass the trade requirements in the properties of color and fire test, the gravity and odor are so far from the requirements of marketable illuminating oil that under no consideration could it be sold as such, provided the illuminating oils from Pennsylvania and even Lima crudes could be obtained.

"The intense odor of the oil would prevent its use as an illuminant, and sulfur in small quantities in crude oil imparts to the distillates a very disagreeable smell, which can only be removed with great difficulty and expense.

"The great bulk of the distillate would be condensed at gravities below 30° Baume, and, on

Thousands of "Boomers" descended upon Beaumont within hours after word of the Lucas gusher had been flashed around the world. This Southern Pacific train was loaded to capacity.

National Supply Co. and Acme Sucker Rod Co. were among the first oil-field suppliers to set up stores in Beaumont. By the end of 1901, operators had over $4,000,000 invested in equipment to drill for and produce Spindletop oil.

account of its low viscosity, could not be used as a lubricant; and assuming the oil has no value as an illuminant and lubricant, it can only be used for fuel, and its terrific odor would prevent its use as a fuel in a thickly populated center."

Aftermath

In the months that followed the discovery, the greatest worry of the operators was the danger of fire. The worry was well founded. On March 3 a spark from a passing locomotive ignited the oil stored in an earthen reservoir covering 100 acres. Lucas estimates that 300,000 bbl. of oil was destroyed in the fire. No damage was done to the well, however, as the well head had been covered with sand as protection against such an emergency.

It was only a few months after this fire that Lucas left the scene of his historic discovery. No one knows the exact amount of money which Lucas made from his venture. It is known that he did not emerge a rich man, as would be expected. Some say he received $25,000 for his Spindletop interests. Other estimates go as high as $100,000.

Bonanza!

Beaumont's Reaction to the Gusher

By nightfall of January 10 news of the discovery had traveled far. Word had gone across the Atlantic that a gusher flowing at the rate of from 75,000 to 100,000 bbl. daily had been found in a town near tidewater—important news to countries using dwindling supplies of coal for fuel. In the financial capitals of the United States the stock market reflected the news, and predictions were made that unless the well proved to be a freak or a crevice well, the day of universal fuel-oil consumption had arrived. A spokesman of the industry said, "Once a sufficient supply of oil is assured, there will be a demand that is not appreciated now."

Into Beaumont within a short time came a mad rush of lease gamblers, fake stock promoters, catchpenny "boomers," and assorted riffraff, along with the merely curious onlookers and a great number of professional oil operators. They came on special trains, in wagons, on horseback, afoot. Beaumont mushroomed into a noisy, oil-crazy settlement, wild as any gold-rush town. On January 14, 2,000 strangers were there to see the gusher, and the Daily Enterprise said:

"Everybody has been too much excited to do business. About half of those who want to do something don't know what they want to do."

Steadily the fever heightened. Tents, one-room shacks, driftwood lean-tos, saloons, and gambling houses appeared overnight. Railroads advertised that "in Beaumont you'll see a gusher, gushing." A hackman with a broken-down surrey and two mules hauled passengers from excursion trains at from $18 to $20 a person from the depot to the field. A party of capitalists waded "with our trousers rolled to the knees" through "raw oil" in order to approach the "geyser."

Peace officers guarded the entrances to the restaurants and allowed only a small number of persons to enter at a time; men stood in line and waited their turn at the tables, where ham and eggs were served at a dollar an order.

The chief of police warned people to walk in the middle of the streets after nightfall. "Tote your guns," he advised, "and tote 'em in your hands, so everybody can see you're loaded." Leases were used for carfare and as poker stakes. A woman who had daily collected garbage in the town sold her pig pasture for $35,000; blocks of real estate measuring 25 by 34 ft. sold for $6,000 each, making land in some sections worth as much as $276,000 an acre. Fly-by-night promoters transacted business with amateur speculators from "offices" on street corners and hotel porches. Stock was

The Fiftieth Anniversary Commission

THE Spindletop Fiftieth Anniversary Commission is a nonprofit, educational organization serving as an official commission appointed by the governor of Texas for the purpose of commemorating 50 years of progress in the modern petroleum industry.

The commission is dedicated to these primary objectives:

1. To commemorate and record for the benefit of history the significance of the Spindletop discovery and its relation to the industrial achievements which followed.

2. To pay tribute to the individuals, groups, and corporate units for their part in the Spindletop discovery and subsequent important developments in the petroleum, natural-gas, and petrochemical industries.

3. To obtain by every available means widespread recognition of the importance of this vital contribution to the expansion and growth of these industries and to the general welfare of the nation.

The membership of the commission includes the following individuals who are serving as an executive committee. John W. Newton, Magnolia Petroleum Co., Beaumont, chairman; Phil S. Justice, Sun Oil Co., Beaumont, vice chairman; Scott Myers, independent oil operator, Beaumont, vice chairman; I. F. Betts, American National Bank, Beaumont, treasurer; W. W. Leach, Magnolia Petroleum Co., Beaumont, secretary; Marion E. Brock, Gulf Oil Corp., Houston, member; F. L. Wallace, The Texas Co., Port Arthur, member; C. W. Cooper, Pure Oil Co., Nederland, member; and Dr. A. M. McAfee, Lamar State College of Technology, Port Arthur, member. Spencer W. Robinson is executive director of the commission.

Activities commemorating Spindletop are scheduled throughout 1951, but the focal point was the ceremony in Beaumont during the week immediately preceding and particularly on January 10, 1951, which is the anniversary date. Four major oil meetings are being held in Beaumont during 1951: Texas Independent Producers and Royalty Owners Association; American Petroleum Institute, spring production meeting, southwestern division; National Oil Scouts and Landmen's Association; and Texas Mid-Continent Oil and Gas Association.

sold so widely throughout the United States that at one time, it is said, a tract of land 45 ft. square was owned jointly by four companies, each capitalized at $1,000,000.

Casing had collapsed in the Lucas gusher, and as 1901 waned, interest centered in other wells crowding the mound. Derricks were rising so swiftly and so close together that workers, fearing trouble, placed plank runways high up between the towers to permit retreat from one to another. In many cases from one to four holes were drilled under the same floor. Soon gushers became commonplace. Pipe lines and refineries were being constructed. Capitalists

The Monument

"ON this spot on the tenth day of the twentieth century a new era in civilization began." So begins the inscription on the 58-ft. granite monument marking the site of the Lucas gusher. It was dedicated October 9, 1941, during the annual meeting of the Texas Mid-Continent Oil and Gas Association at Beaumont.

The impressive structure was financed and erected by the Lucas Gusher Monument Association headed by J. Cooke Wilson, president; Stephen W. Pipkin, vice president; Scott W. Myers, secretary; and Marion E. Brock, treasurer. The association was incorporated July 9, 1940. Companies and individuals donated the money to make the monument possible.

A committee headed by the late George A. Hill, Jr., composed the stirring inscription for the monument. Other committee members were L. W. Kemp, Charles Warner, and the late Ike Moore.

First discussion of the idea of building a monument over the site of the gusher arose in 1920 during a meeting of Spindletop operators on waste disposal. Following the meeting, Marion Brock petitioned the Beaumont Chamber of Commerce to sponsor the project. This group declined at the time and it was 20 years before Brock's proposal became a reality.

Al W. Hamill, of Tulsa, one of the drillers of the famous gusher, made a special trip to Beaumont to help the monument committee find the exact well site. Few people in the Beaumont area had any idea, 40 years after the discovery, where the well was drilled.

The monument was designed by Donald Nelson, architect, and Pierre Bourdelle, sculptor. It is built of Texas pink granite from the quarries of Premier Granite at Llano.

Old Timers Gather at Spindletop Celebration

Left: J. H. Little, Belton, Tex., and A. F. Tarver, Shreveport, (both formerly with J. M. Guffey Co.). Right: Charles R. Stevenson, Port Arthur (Gulf Oil Corp.—1902); Judge Beaman Strong, Beaumont (Yount-Lee Oil Co.—1925); and J. H. Goodwin, Nederland, Tex.

Left: Fred Driehs, Beaumont (Magnolia Petroleum—1903); Capt. Thomas Fenlon, Hunt, Tex. (Magnolia). Right: Lip Norvell, Beaumont; Judge Strong; Al Hamill, Tulsa; Tobe Hahm, Beaumont.

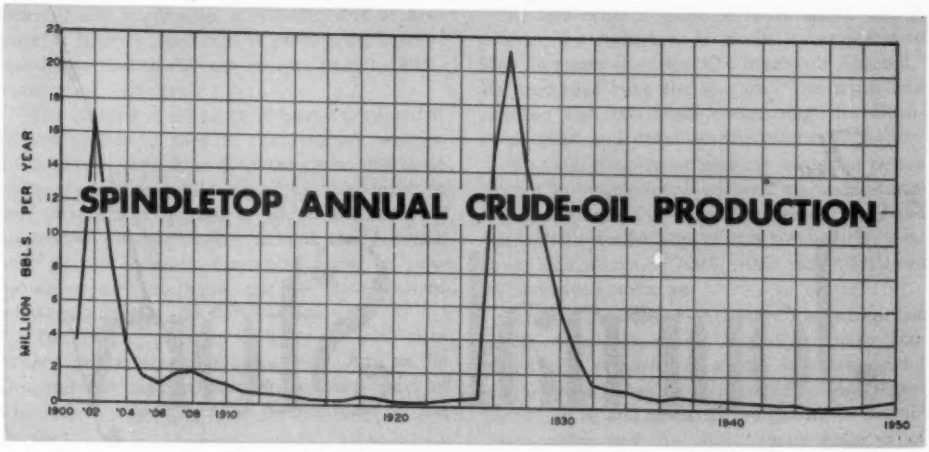
Left: O. L. McKinley, Beaumont, (United Oil and Sun Oil); F. R. Balcar, Caldwell, Tex. (Higgins Oil & Fuel Co.); C. J. Mitchell, Beaumont (Heywood Oil Co.). Right: J. W. Kinnear, South Park, Tex. (Star Petroleum Co.); and Pattillo Higgins, San Antonio.

now active in the field began to stabilize the local oil industry.

By the end of 1901 there were 585 oil and leasing companies in Beaumont with approximately $4,371,085 invested in wells, storage plants, pipe lines, and the like. There were 138 producing wells. Beaumont's population had doubled in this year, although the boom peak total of 50,000 had dwindled, so that newcomers and old residents now numbered not more than 20,000. The oil industry alone had used more than a billion feet of pipe during 1901. Beaumont claimed "more locomobiles and automobiles" than the whole State of Texas.

The Field

STRANGELY, the three most significant dates in history of Spindletop mound have come at 25-year intervals. In 1901, Captain Lucas brought in the greatest oil well the world had ever seen. In 1926, Miles Frank Yount discovered prolific flank production to revive the declining field. In 1951, Stanolind Oil & Gas Co. has discovered a new oil pay, and Texas Gulf Sulphur Co. is constructing a $10,000,000 plant



Spindletop field has reached two big production peaks during its 50-year history. A year after discovery, it had an annual production rate of 17½ million barrels—a record which stood for 25 years. In 1926, the Yount-Lee Oil Co. found some prolific flank production, and the following year the field reached its second peak with 21 million barrels of oil.

to extract sulfur from the mound. Spindletop has refused to say die.

First 25 Years

It was in January 1901 that Captain Lucas found oil in the cap-rock area overlying the top of the huge mound of rock salt lying 2,000 ft. below the surface. By October of 1901 there were 65 flowing wells "any one of which is equal to the famous Lucas geyser," according to a periodical of the time. In that year Spindletop field produced over 3½ million barrels of oil. By the following year the field had risen to an annual production of 17½ million barrels—a record which was to stand for 25 years.

When Spindletop was discovered, Russia was the world's largest producer of crude oil. Three years earlier, it had overtaken the United States which had led the world for 40 years. However, by 1902, as a result of the prolific Spindletop production, the United States took the lead and has never since lost it.

Second 25 Years

Spindletop steadily declined until 1925 when production was 412,000 bbl., a daily average of 1,100 bbl. In that year Yount-Lee Oil Co., headed by Miles Frank Yount of Beaumont, started exploring around the salt dome for flank production. The company drilled two dry holes, but early in 1926 was liberally rewarded for its efforts. The 2 McFaddin, due south of and just off the salt plug, found a good pay at 2,518 ft. This well set off the second Spindletop boom—a boom which has enabled the field to produce over 1½ times as much oil in its second 25 years as in the initial quarter century.

Peak production year for the second 25-year period was 1927 when the field produced over 21 million barrels (58,000 bbl. daily). A total of 2,200 wells have been drilled in the 430 acres comprising the field. Cumulative oil production to January 1, 1951, has been 129,952,000 bbl.

Geology

The major oil production at Spindletop field now comes from the south, southwest, and west flanks of the dome. The oil is found in the middle and lower Miocene and to some extent in the middle Oligocene formations. The sands are very lenticular and irregular, and correlation from well to well is difficult.

The 1901 production was from cavernous dolomite in the cap-rock area of the dome. Thickness of productive sands ranges from 10 to 210 ft. The dome itself is elongated with a southeast-northwest trend and is roughly 1 mile in diameter at its top. The flank area of deep production contains 150 acres, the old cap-rock area 280 acres. Gravity of the various types of oil produced ranges from 25° to 30° A.P.I.

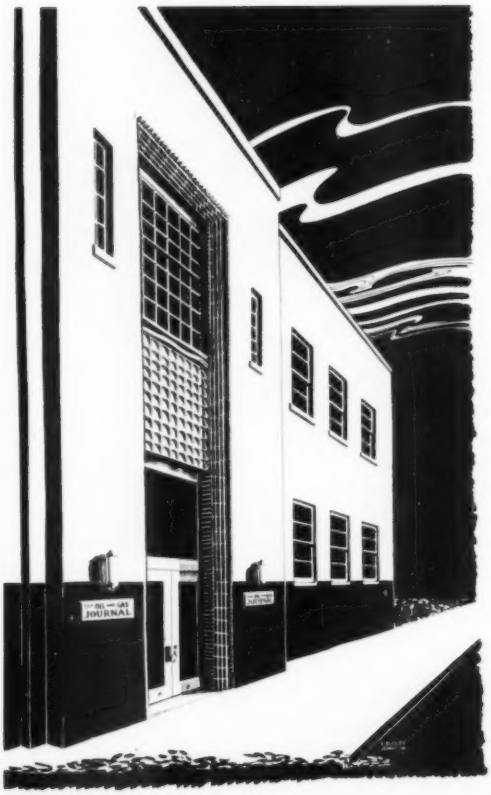
Relative Size

Spindletop field still holds a high rank among the fields of the Texas Gulf Coast. It has been a giant in this area of prolific oil fields, where only five fields have surpassed its cumulative production.

The Journal Story

Interwoven with the history of the oil industry for half a century is the story of this publication's growth by service in presenting information and formulating opinion

by Henry D. Ralph



1. Genesis and Genius

"... the truth and nothing but the truth ..."

AS Spindletop saw the birth of the oil industry in the Southwest, so it also saw the birth of The Oil and Gas Journal.

And, like the industry, the Journal centered in Beaumont for several years and then expanded its interests throughout the Southwest and the world.

Paralleling its industry, at times it changed its operating base, its interests, its appearance, and even its name. But from the first it was the Journal of oil, and for half a century it has been the authoritative spokesman and vigorous defender of operating oil men.

Many oil papers were born and died during that half century. The fact that one persisted and grew was no accident. From the first the

Journal had a purpose, a mission, and a message; it filled a need and it performed a service. From this it did not waver, despite difficulties and changes.

The history of oil as an industry is recorded in the yellowing files of the Journal, written by scores of men long forgotten who did their daily stint of factually reporting the activities and interests of the men of oil. As the industry expanded geographically, so did the Journal, and as the industry interested itself in new products, new methods, and the development of technology, so did the Journal.

The history of the industry is told elsewhere, and it is a fascinating story. And as the Journal has always been an intimate part of the industry its story is an integral part of that history.

This is the Journal Story.

It is a story of oil and also of journalism, and it reflects the changing conditions in both. But essentially it is the story of why a tiny publication found life in the rough and tumble of the boom days, why it persisted as the organ of a fast-growing industry, and why it became one of the leading industrial publications of the world.

The time was 1902. The fabulous Spindletop field had been blowing and booming wild for a year. Adventurous men and loose money were pouring into Beaumont from all over the world. Oil in Texas was a promoter's carnival. Facts were lost in the frenzy, and fraud had a bonanza. Eastern newspapers carried false reports that the southwest oil boom had collapsed, that Spindletop's gushers had gone dry overnight. Investors were unloading stocks in panic, and oil operators, relying on public finance, faced ruin.

In this crisis a voice of truth spoke out to protect the industry. It made its appearance May 24 under the title "Oil Investors' Journal." Its masthead bore the slogan: "The truth and nothing but the truth concerning the Beaumont field and other southwestern oil fields."

The significance of such an editorial policy cannot be appreciated without an understanding of the nature of the oil business and of the journalistic profession at the turn of the century. The ethics of both were sadly deficient by modern standards.

In Beaumont and the other embryonic oil areas of the Southwest the oil industry consisted of a minority of actual operators and a majority of "blue sky" promoters. Most operators had to sell stock to the public to finance their wells, and the public knew little of oil except that it offered a chance to get rich overnight. It was open season for unscrupulous promoters, and their stock in trade was false rumors of marvelous gushers and disastrous failures which sent the oil stocks up and down and made easy pickings for the manipulators.

And the newspapers of that day played into

The roguish wit of Holland S. Reavis put sparkle in the little Oil Investor's Journal which he founded in the midst of the Spindletop boom. But as its first editor and publisher he set standards of service and excellence which later were expanded into the industry-wide Oil and Gas Journal.

Oil Investors' Journal

THE TRUTH AND NOTHING BUT THE TRUTH CONCERNING THE BEAUMONT FIELD AND OTHER SOUTHWESTERN OIL FIELDS

VOL. 1. BEAUMONT, TEXAS, U. S. A., MAY 24, 1902 NO. 1.

GET THE FACTS.

Never before has there been such widespread demand for absolutely accurate and trustworthy information concerning ... Beaumont oil field and ... rious companies operat... as exists today.

Reports published in ... and Eastern newspa... in the present month ... fect that the gushers, ... sult of a South Ameri... quake, had ceased ... suddenly as the ... started spouting, ha... ated the already ... a true statement of t... of Spindle Top ... relative to the ga...

Oil men have in... disturbed by these ... realize that the ... oil business in a ... are far more corre... a gusher field ... dred or more ... holdings.

It is the ma... led to purchase ... single inducem... poration who... owns a grea... anxious to kno... is legion.

With conditions as they are—such a general craving for the facts—it is not too much to assume that THE OIL INVESTORS' JOURNAL begins its career at an opportune moment. It comes to supply a want, to occupy its place in the field of legitimate journalism which has been created by the natural sequence of events following the discovery of a marvelously productive oil field. Adhering to a strict policy of honesty and accuracy in its news reports, publishing the truth and nothing but the truth without fear or favor to any individual, firm or corporation, there is no reason why it should not receive the support of the people and become a permanent institution, worthy of the confidence of all good men and the enmity of all fakirs.

idence of all good men and the enmity of all fakirs.

It will be an inviolable rule of the management of the JOURNAL in every instance to prevent the ... news columns for ad...

This paper ...

as the result of an earthquake in South America—the exact location of the disturbance in South America being omitted.

Telegrams by the score and letters by the hundred have poured into Beaumont since the publication of these reports, in... general unrest... caused. Al... tion there ... from hold... or from ... When intend... ren... ability the ... favor to de... tion at Spin... information ... the eye has ... the ear has ... ren.

... day after the ... and other lead... published the ... that the gush... ing, a party of ... correspondents ... to Spindle Top ... purpose of test... to ascertain ther... gone existing. In... A. Hill superin...

... well near the ... Block 30, Hogg ... and adjoining the ... perty, was opened ... means were resort... state the well. A ... ced before the oil ...

When it came it ... heavy stream through ... ch elbow, which had ... at an angle of 45 de... discarded boiler, not ... 100 feet distant from ... and not more than 150 ... — no one measured the ... in exact figures — was ... ed by the oil from the ...

The flow was continuous ... seemed to grow stronger as ... well cleaned itself out. ... When all present had been sat... isfied that this well was still a ... gusher the oil was checked and ... the party proceeded across the ...

There was a little oil in Texas before Spindletop, and Texans bragged about it as in this 1895 picture of the first tank car shipped from Corsicana, but it was at Spindletop that oil became an industry.

their hands. The press seemed to care little for fact, at least where oil was concerned, and the wilder the rumor the bigger the headline. Worse, it was not uncommon to accept pay for printing propaganda as news. There were oil papers, too, in those days, but many of them were nothing but organs of stock promoters masquerading as legitimate journals. Fact was a rare commodity in the oil business in 1902.

So there was a degree of novelty as well as courage and foresight in that lead article in Volume 1, Number 1, which said:

"The Oil Investors' Journal . . . comes to supply a want, to occupy its place in the field of legitimate journalism . . . Adhering to a strict policy of honesty and accuracy in its news reports, publishing the truth and nothing but the truth without fear or favor . . . It will be an inviolable rule to prevent the use of its news columns for advertising purposes . . . It must seek to command the respect and confidence of its readers above all other things . . ."

Strong institutions are built by strong people, and the Journal's early strength was the strength of one man, Holland S. Reavis, its founder and editor for 8 years. Reavis was a genius of a sort. He had left a St. Louis newspaper to ride the Beaumont boom as a broker of oil stocks, but his reporter's instinct rebelled at the fraud and hypocrisy he found. His integrity is shown by the fact that while he used paid advertising to sell his stocks, the news columns of his paper never promoted his companies.

Those were the days of personal journalism, when most publications wore the personality of their editor, and The Oil Investors' Journal was Holly Reavis' alter ego. He continued to operate as a promoter and developer of oil properties, but the Journal was his hobby and his passion, the outlet for his restless energy and his facile pen. He had reporters and correspondents, but he set the policy and the standard and breathed life into mundane reports.

Scouts in Borneo and drillers on the Black Sea opened their Journal and spent their hours with Reavis. As he roamed the Southwest oil fields he gave them all the facts of their industry, charts, maps, photographs, statistics, reports on every success and every failure, the condition of every field, the progress of every project. And for full measure he gave them a unique friend in himself. His columns sparkled with wit, dripped with sarcasm, burned with indignation, and glowed with truth. Above all he reported facts—detailed, authenticated, unbiased.

During the 8 years that Reavis nursed his infant publication, the oil business in the Southwest changed rapidly from a speculator's paradise to a stable industry, and under his guidance the Journal developed a pattern of service to the industry which laid the foundation for its growth into a national and international publication.

Its founder gave the Journal its priceless ingredients which led to a steady and enduring growth, and he set standards and policies of publishing which never changed — integrity, accuracy, impartiality, authoritative statistics, timely news reporting, coverage of the entire industry, editorial support of sound and progressive policies, service to its industry, and paid and unpadded circulation.

2. The Time and the Place

Steady development supplants frenzied finance

THERE was indeed a need for an organ of truth in the southwest oil fields in 1902. Spindletop was in its second year but some of its gushers had ceased to flow and there were reports that the field was through. Sour Lake and Jennings fields had been brought in, resulting in a flood of oil that glutted the market and overflowed huge earthen reservoirs. Distressed producers offered crude at 3 cents, even 1 cent, a barrel. Eastern "experts" said Beaumont crude was sulfurous and unmarketable. Rumors were rampant, and both bulls and bears found believing ears.

Into this casino atmosphere, where the turn of a rumor spelled riches or ruin, came The Oil Investor's Journal. Boldly its columns defined the southwest oil fields as an industry; its developers were to be supported, its detractors and parasites expelled. It reported actual operations, everything it could confirm about wells staked and completed and their performance, and news of operators' plans for pipe lines, storage tanks, and other installations. It collected statistics on production and shipments, and reported comments of oil men, casual visitors, and other publications regarding the oil business everywhere.

Many of the new oil companies in the region were honestly financed and soundly operated, and these the Journal championed while outspokenly denouncing unscrupulous promoters and rumor mongers. It described the properties, methods, backers, and financial structure of companies it considered sound and exposed unmercifully the "paper" corporations more interested in sucker money than in oil development. And a favorite topic was the wild and baseless stories about oil in the daily press, denounced by Reavis' vitriolic pen as "fakirs," "opium smokers," "rotten yellow slop," and "damphool lies."

The Oil Investor's Journal announced itself as a semimonthly, subscription price $1 per year, and by fall it had achieved a paid circulation of 1,000 and announced that no more copies would be distributed free — a policy which has never been changed. Its first issues contained 16 pages, well edited and printed, and with an occasional photograph. It had a fair volume of advertising, chiefly from Beaumont banks, brokers of oil stocks, railroads, and producers with crude for sale as fuel oil.

All through its first summer and fall the infant Journal hammered away at the theme that southwest oil was not a fly-by-night pro-

The confusion of derricks at Spindletop matched the confusion of information about oil, which the Journal undertook to dispel.

motion but a solid industry destined for certain greatness. It described the refineries built and building in the Beaumont area as evidence that responsible operators considered the fields good for a long life and the sulfurous crude capable of being made into marketable products. It listed the pipe lines, storage tanks, and railroad loading racks under construction, and described the eastern oil men and capital moving into the southwest pay, to show that the foundation was being laid for a steady growth and a stable and substantial industry.

When Spindletop gushers ceased to flow, the Journal countered the pessimism by pointing out that with the promoters gone the real operators had an opportunity for sound development and declared that "Spindletop on a pumping basis will be a better proposition, so far as the real oil business is concerned, than Spindletop with its hundreds of gushers on back-yard tracts."

From the first it collected statistics on drilling, stocks, shipments, and prices, and occasionally carried a discussion of economic factors affecting the oil market or views of operators on the best methods of finding and producing oil.

Thus at the outset the Journal began to get away from the restrictions of its name and was as much a journal for operating oil men as for investors. Within a year the Beaumont Oil Exchange folded up, and the Journal noted its passing without regret. It had already deserted the investors and had dedicated itself to the interests of the oil developer.

The era of frenzied finance was over, and oil was now an industry, not a grab bag. The Journal ceased running financial news, and its market page was devoted to the economics of the industry and the factors influencing the price of crude and products. The word "Investors'" in its title already was an anachronism.

In keeping with its new field of endeavor, the little paper changed its name to "Texas-Louisiana Petroleum Record and Oil Investor's Journal," and undertook to give complete drilling reports for every field in the region. Its statistics became accepted as authoritative, and the Journal became indispensable to the industry.

Circulation was growing, the paper's reputation was established far and wide, letters of congratulation and endorsement were routine, and the Journal was widely quoted by other publications. But as a business venture the little paper came close to failure.

3. Growing Pains

Statistics and equipment find their place

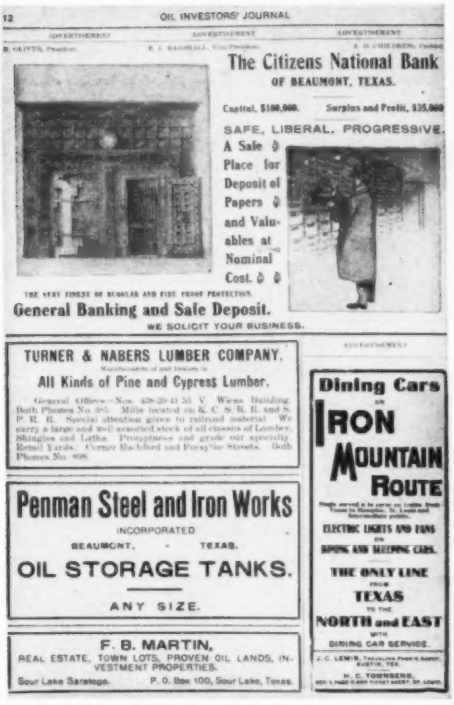
DURING the first year or so of its life the Journal's advertising problem was simple. Editor Reavis sold full-page ads to Broker Reavis. Other brokers and promoters, several railroads, and some of the Beaumont banks continued to buy considerable space. But the volume began to slide off.

Then a Beaumont lumber company cautiously placed a 2-in. ad in the Journal. Orders rained in from distant states, emptying the yard. The company regretted its rashness and withdrew the ad.

But this set Reavis to thinking about the true nature of his outgrown hobby. He had a bear by the tail and he needed help. That help, he reasoned, should come from advertisements by the oil industry and by those with equipment to sell to the industry. In his editorial columns he appealed for such assistance.

Moral support and good wishes came from many sources, but the needed financial support was slow to materialize. It was not until August 1903 that the Journal landed its first oil-equipment ad—a 2-in. card from Penman Steel & Iron Works of Beaumont announcing "Oil Storage Tanks, Any Size." Before long there were a few other small advertisements by drilling contractors and sellers of pipe, fittings,

Some stability in oil began to come with the construction of refineries like this Port Arthur plant of Gulfey & Galey in 1902.



12 OIL INVESTORS' JOURNAL

ADVERTISEMENT

The Citizens National Bank
OF BEAUMONT, TEXAS.

Capital, $100,000. Surplus and Profit, $35,000

SAFE, LIBERAL, PROGRESSIVE.

A Safe Place for Deposit of Papers and Valuables at Nominal Cost.

THE VERY FINEST OF BURGLAR AND FIRE PROOF PROTECTION.

General Banking and Safe Deposit.

WE SOLICIT YOUR BUSINESS.

TURNER & NABERS LUMBER COMPANY.

All Kinds of Pine and Cypress Lumber.

General Offices—Nos. 429-30-31-32 V. Wren Building Both Phones No. 485. Mills located on K. C. S. R. R. and S. P. R. R. Special attention given to railroad material. We carry a large and well assorted stock of all classes of Lumber, Shingles and Laths. Prompt ness and grade our specialty. Retail Yards, Corner Richford and Forsythe Streets. Both Phones No. 908.

Penman Steel and Iron Works

INCORPORATED

BEAUMONT, - TEXAS.

OIL STORAGE TANKS.

ANY SIZE.

F. B. MARTIN,

REAL ESTATE, TOWN LOTS, PROVEN OIL LANDS, INVESTMENT PROPERTIES.

Sour Lake Sanatoga. P. O. Box 100, Sour Lake, Texas.

Dining Cars on IRON MOUNTAIN ROUTE

ELECTRIC LIGHTS AND FANS ON ALL DINING AND BUFFET CARS.

THE ONLY LINE FROM TEXAS TO THE NORTH and EAST WITH DINING CAR SERVICE.

J. C. LEWIS, TRAVELING PASS'R AGENT, AUSTIN, TEX.

H. C. TOWNSEND, GEN'L PASS'R AND TICKET AGT. ST. LOUIS.

The first advertisement for oil equipment was tucked inconspicuously among the announcements of banks, brokers, and railroads in 1903.

Batson Field Views Texas Petroleum Statistics for 1903

Oil Investors' Journal

Single Copies 5c.

VOL. 2 BEAUMONT, TEXAS, U. S. A., JANUARY 15, 1904. NO. 10

BATSON IS A GREAT FIELD.

In the Batson Oil Field.

Statistics were already an important feature of the Journal in 1904, and photographs of new wells were used extensively.

and tools, but by the next spring the Journal was down to 12 pages, seldom more than 2 of them advertising.

The crusading editor met this challenge with a determination to make his little paper invaluable. He discontinued his own brokerage advertisements and devoted himself to traveling the oil fields and writing detailed, first-hand reports on all developments along the entire Gulf Coast. He gathered more and better statistics and occasionally printed maps of oil fields and pipe lines. And to provide some human interest and to give vent to his inborn ebullience without doing violence to his reputation as a serious reporter he added a column of short squibs by "The Tank Strapper"—pithy paragraphs and wry remarks about the oil business, politics, the tribulations of an editor, and life in general.

The first January issue of 1905 was something of a landmark in petroleum publishing—the first of the Journal's famous annual review and statistical issues. It reviewed the development and production of the Gulf Coast fields and tabulated shipments of crude and products from terminals and refineries. This made such a hit with subscribers that the Journal redoubled its efforts to gather more and better statistics and trade news.

A month later the Journal printed a 24-page issue, biggest in its history up to then, on slicker paper and profusely illustrated with photographs of oil operations. There was a gratifying volume of advertising, including the Journal's first full-page ad for oil equipment—a blowout preventer manufactured by H. P. Decker of Beaumont.

The Journal was catching on, and advertisers realized its value. From then on it never had less than 20 pages an issue and frequently it had 28 or 32. One of the old-line supply houses, National Supply Co., of Pittsburgh, became a regular advertiser in March 1905, and was soon joined by many other distributors of equipment.

In 3 years of hard-hitting journalism and straightforward reporting it had built up a widespread and loyal readership among oil operators and had become the recognized organ of the southwest oil industry.

4. New Horizons

Along the gulf . . . big business . . . widening activity

THE years 1905 and 1906 were full ones for the oil industry. New fields were being discovered in the Gulf Coast area, but the Texas-Louisiana industry had competition. Production was developing in Illinois, in Kansas, and in Indian Territory, and foreign development threatened the export markets. Some oil companies were growing into giant corporations which fought among themselves for production and markets. The Standard Oil Trust was a target of muckrakers in the yellow press and in politics, and the federal Government began to take an interest in investigation and regulation of the oil industry.

All this was factually reported in The Oil Investor's Journal. Reavis and his staff roamed the Southwest, visiting every new operation, reporting every development of the trade. The paper was packed with facts, but there was lively reading when the sharp-tongued Reavis editorially took the hide off a promoter, a politician, or some other editor whom he accused of doing the oil industry an injustice; or when he allowed the Tank Strapper to voice his roguish wit and sarcasm.

A few random headlines show what interested the Journal and the industry in that period:

Guffey Company using a gas engine with success at Batson.

Legislation to prevent reckless drilling in the Texas fields.

Texas oil and its value for gas making and fuel.

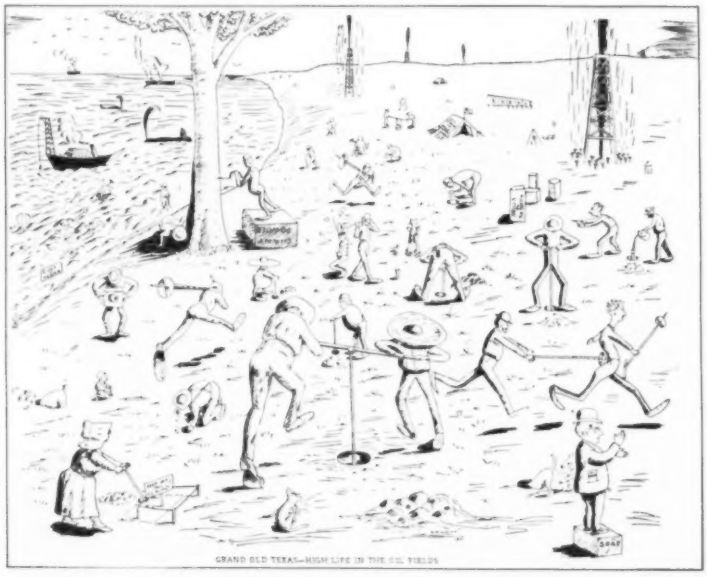
Gulf fields produced 40 per cent of American yield in May.

An advance in the method of drilling by the rotary process.

Importance of the petroleum industry in Borneo.

Great strides made by liquid fuel on the Pacific Coast.

The big oil topic of the day, both in and out of the industry, was John D. Rockefeller and his Standard Oil Co. Toward this the Journal took an objective view. While the Tank Strapper thoroughly enjoyed himself poking fun impartially at the oil magnates of Wall Street and their muckraking detractors, the



The oil fever spread rapidly along the Gulf Coast to the amusement of this contemporary Dallas News cartoonist, but to the Journal it brought new interests and a new challenge.

OIL INVESTORS' JOURNAL 11

Orient Buckboard

WITH TWO SPEED

A little machine that has in one year gained a reputation bounded only by the limits of the earth.

PRICE, $425

Write for Handsome New Catalogue.

WALTHAM MANUFACTURING CO.

WALTHAM, MASS.

WHITE BICYCLE CO., Local Agents, Pearl Street, Beaumont, Texas.

The first automobile ads appeared in the Journal in 1904, but the oil industry wasn't much interested in gasoline then.

Journal said editorially that it was neither for nor against Standard but was interested only in reporting the truth. In a matter-of-fact way it printed the texts of official charges, investigation reports, company statements, and court decisions.

The Journal's crusading was reserved for unscrupulous promoters and untruthful reporters, who injured the industry's reputation. Printing what it could pick up about oil development in Illinois, Pennsylvania, California, and in foreign areas, the Journal continued to devote its major attention to the Gulf Coast.

Its devotion to the Gulf Coast paid off in the annual review and statistical issue of January 1906, which gave such complete and authoritative information that it was widely reprinted by other papers and the information was published as a pamphlet to meet continuing requests. Advance proofs of its statistics and drilling reports were regularly sent to newspapers in the Southwest and elsewhere, and were widely used. Its circulation grew and so did advertising, and issues varied from 28 to 36 pages.

It was a going concern.

5. Expanding Interests

Indian Territory . . . Yellow Cover

BIG things were stirring in oil during 1906, particularly in Indian Territory where Glenn pool was attracting national attention and oil strikes were being reported in many other areas.

The Territory, as it was called, had much to attract any oil man and any writer, and Reavis spent much of his time in that active and hectic area. Late that fall the Journal uncovered the fact that both The Texas Co. and the then-reorganizing Gulf Refining Co. were definitely planning to build crude lines from Glenn pool to the Gulf Coast. This was big news, and showed that Oklahoma was on the oil map to stay. Boldly the Journal headlined:

"Tulsa Now the Oil Center."

Reavis followed up this declaration by staying in Tulsa where his reporting ability found full play. By mail and telegraph he filled many columns of the Journal with details of the rapid development of Oklahoma oil and its significance to Gulf Coast oil men.

News was what the oil industry wanted, and news the Journal gave. That spring it opened an office in Tulsa, and invited all vis-

NEW PERFECTION WICK, Blue Flame

Oil Stoves

Are best. Simple in Construction; Safe and Reliable; Always Ready; a Working Flame from moment of lighting; Concentrated Heat gives Quick Results.

FOR SALE BY

Waters-Pierce Oil Co.

Oil companies bought space in the Journal to plug the sale of stoves and widen the market for kerosine, their chief product in 1906 when this advertisement appeared.

iting oil men to make it their headquarters, offering easy chairs, maps, advice, and exchange of oil talk. A resident Tulsa correspondent was put in charge, while the editor roamed the Mid-Continent. A Washington correspondent was hired, and he found much to write about the federal Government's growing interest in conservation and regulation of oil.

The words "Texas-Louisiana Petroleum Record" were quietly dropped from the title. The Journal was now a national and international publication.

With such a growth, Reavis decided his baby should have a dress. Until the spring of 1907 the Journal had appeared without a cover, and its front page looked more like a tabloid newspaper than a magazine. A contest was run among subscribers to name a color for the proposed cover.

Reavis' roguishness was at its best when it came time to make the selection. He settled on the most brilliant yellow he could find—simply because that was the one color nobody had suggested. In the issue of February 18, 1907, he explained it this way:

That Loud Noise? It's the Journal's New Cover

It was inevitable. We figured it out in advance, and it came to pass just as we had expected. With a very few exceptions, all of our friends took advantage of the opportunity to tell us about it. Some of them wrote letters. This one from O. W. Heywood at Jennings, La., is a specimen:

"I am very sorry to see that you have joined the Hearst brigade, and have commenced to publish a yellow journal. I was in hopes you would keep the Journal in the front rank, as it has been in the past. This is probably one of the criticisms you will not publish, as I notice in each issue you give quite a little space to parties who 'jolly' you about the paper."

When we first broached the matter of putting a colored cover on the Journal, some of our friends suggested pink, others baby blue, still others a delicate shade of lavender. Some thought a rose-colored cover of scented paper would help newsstand sales in rural districts of Louisiana. No one said anything about yellow. That's why we selected it—the ugliest color in the catalog. It is hideous, calculated to disturb the peace, and make Willie Hearst mad with jealousy. But, unlike Willie's publications, the yellow in the JOURNAL is all on the cover. We promise to keep it there. So long as we do, the deaf and the near-sighted will have no trouble picking it out on the newsstands. In its new garb the Journal truly "speaks for itself."

From that day on the Journal has been known affectionately by oil men all over the world as "The Big Yellow Book."

6. Coming of Age

Too big for the Tank Strapper

GREAT expansion marked the oil industry during the period of 1907 to 1910, and the Journal expanded with it. It carried news reports from California, Illinois, Kansas, Wyoming, the Appalachian area, Russia, Mexico, Borneo, and elsewhere, and its Washington correspondent found much to report in the federal Government's increasing concern with regulation of the industry.

But its major attention was devoted to Texas and Oklahoma, and in this area its statistics and drilling reports were accepted as authoritative. The Journal's Tulsa correspondent filled many columns of each issue and usually "made" the front page. In August 1907 the Journal ran what might be called the first special issue, a lengthy resume of developments in Glenn pool, well illustrated with photographs of operations in the area.

American oil men were not much interested in the scientific aspects of their business, and the pages of the Journal reflected this. Now and then there was a government report on geology, or a random contribution by an oil man discussing some aspect of oil occurrence or well completion, but by and large the Journal stuck to reporting news, statistics, and personals—interlarded with salty comments by the Tank Strapper.

The 1908 annual review issue was so popular that the statistics were reprinted in a

Texas oil scenes made popular post cards, like this 1909 card showing the state's first big gas well, at Petrolia.

At the time the Journal moved to Tulsa the big oil news in Indian Territory was the construction of pipe lines to the gulf, and this old Journal photo shows a crew of hand laborers stringing pipe through a cotton patch.

pocket-sized "Dope Book" which got wide distribution and many favorable comments. The Journal's statistics already had become the standard guide for the industry. That year the Journal deserted Beaumont and was published in Kansas City for several months and then in Houston.

The growing stature of the Journal was shown in its 1909 annual statistical issue. The Tank Strapper announced it this way:

"If you've got something to advertise and you don't take space in the big number of the Journal on February 6 you are asleep at the switch, your own worst enemy, suffering from acute paralysis of your business foresight, and don't know a good thing when you see it. Write, telegraph, or telephone. Space $50 a page while it lasts."

The issue lived up to its promise. It ran 100 pages, including the first two-color advertisements it had ever carried, and was packed with figures and review summaries covering every oil section of the United States and some foreign countries. A total of 10,000 copies were printed, and all extra copies were sold out (at 25 cents) within a week.

On the strength of this success, the Journal raised its subscription price to $4 a year. And when a few subscribers presumed to complain, the Tank Strapper rejoined:

> "We would be ashamed to take four bits a year for a scissors-and-paste publication. We are ashamed to get only four bucks for the Great and Only. We have it on good authority that Joseph Pulitzer, W. R. Hearst, James Gordon Bennett, and Pat Boyle have marveled how we can do it at the price. Never before in the history of the universe has such a mass of original and timely dope been put out to the public at four bones per. There is no substitute for it. It can't be counterfeited. No news dealer ever thinks of saying 'Here's something just as good.' Modesty forbids dilating further on the merits of the Old Rag."

That reference to Pat Boyle, publisher of the Oil City Derrick, may have been prophetic. Little more than a year later Boyle owned the Journal and was finding out for himself how to do it "at four bones per."

Meanwhile the "merits of the Old Rag" were not unnoticed by the oil industry. The Journal regularly ran 32 or 36 pages per issue, advertising was heavy, and the ubiquitous yellow cover was displayed on newsstands in New York, Chicago, California, Mexico, and Canada, as well as in every important oil town of the Southwest and Mid-Continent.

The Journal not only was established, it had become big business. The little sheet so valiantly launched to fill a local need during the Spindletop boom had in 8 years gained world-wide recognition as one of the leading business publications of the country. Reavis' other interests were pressing and his beloved Journal could no longer be conducted as a hobby or a sideline. The time had come for the child to leave the parental roof.

In the Journal of April 20, 1910, Reavis bade farewell to his readers and announced the sale of the paper to a new firm, Petroleum Publishing Co. The new management pledged itself to maintain the policy and standards of the publication and to enlarge its service to the industry, and this promise was kept.

The qualities bred into the Journal during its formative period proved their worth as the publication moved into adulthood.

7. Under New Management

From a personal organ . . . an industry institution

IN its new corporate form the Journal was no longer a personal organ, but a business concern. But it was in skilled hands.

Organizer of Petroleum Publishing Co. was Patrick C. Boyle, publisher of the Oil City Derrick. Pat Boyle was one of the outstanding newspapermen of Pennsylvania and a pioneer in the calling of oil reporter. After working for many years in the oil industry of western Pennsylvania in various capacities, including serving as oil writer for a number of newspapers, he acquired the Oil City Derrick in 1885. He made it a unique publication, a combination daily newspaper and trade journal. To follow the spread of the oil industry from its birthplace, the Derrick had by 1910 built up a nation-wide staff of trained oil reporters which was immediately assigned to the newly acquired Journal.

The two publications fitted together like hand in glove, for Boyle's guiding philosophy was that the welfare of the oil industry depended on accurate reports, facts, and statistics on drilling, production, runs, and other operations. He placed the Journal in the hands of some of the Derrick's best men, men familiar with oil and with publishing. These men and the many other trained oil writers who followed through the years built on the foundations and traditions of both Boyle and the old Journal to develop an institution which thereafter rested on its own character rather than the personality of any one individual.

The publication's name was changed immediately to The Oil and Gas Journal and its publication office was moved to Tulsa. It became a weekly, its page size was enlarged, and its content was increased by the reports from the Derrick's many field correspondents.

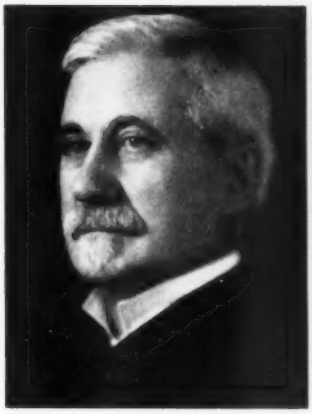
The first issue under this new regime was Volume IX, Number 1, Thursday, June 16, 1910. Its lead editorial promised to give its readers regularly reliable reports from every state and district in the United States where oil and gas are produced, written by men who know the practical end of the business, free from local, personal, and class bias.

From the start the renamed Journal set out to imbue oil men with an industry consciousness and responsibility—and to be the organ for the entire industry. An early editorial theme was a plea to submerge sectionalism, fights between majors and independents, and rivalry among producers, pipe lines, and refineries, and to form a united front to defend the oil and gas industry from its attackers and detractors. Time and again the Journal vigorously struck out at the industry's snipers, at bureaucratic attempts at regulation, and particularly at the then-popular brand of conservation which preached "withdrawal" of oil lands and locking them up for some indefinite future.

The enlarged Journal was now printing an astonishing volume of news and detailed field reports from all over the country. Its statistics, collected at great expense, were most exten-

In its first issue under its new name, the Journal explained its editorial objectives.

The Oil and Gas Journal has essayed the somewhat difficult task of trying to represent fairly and consistently each and every interest involved in the oil and gas industry, delocalized and depersonalized, by the presentation of all the material facts of development and intelligent progress of a great and international business. Within the decade the industry has expanded to boundaries where no one combination has a monopoly, hence the monopoly argument is not now relevant as a final excuse for local failures. There are now so many reputable agencies in the pipe line, the refining and the distributing branches of the petroleum industry that no one can possibly control to the exclusion of part or all of the others. There are so many more producers than pipe liners and refiners and marketers that by sheer force of personality and numbers they can exercise a protective control over their own destinies if they seriously and intelligently essay the task; provided always, however, that equity governs. The natural presumption is that all these related interests are legitimate and entitled to recognition, and The Oil and Gas Journal will follow the presumption to its logical conclusion, as the one national representative of all interests.



PATRICK C. BOYLE

FRANK T. LAUINGER

P. C. LAUINGER

Management of the Journal has been handed down through three generations of publishers since 1910 when Patrick C. Boyle, publisher of the Oil City Derrick, bought the Oil Investor's Journal, moved it to Tulsa, and converted it into The Oil and Gas Journal. On his death in 1920 the management passed to Boyle's son-in-law, Frank T. Lauinger, a Pittsburgh businessman who brought management acumen and a staff of technical journalists which raised the Journal to its present stature. Since 1931 the Journal's publisher has been P. C. Lauinger, son of Frank T. Lauinger and grandson of Pat Boyle, whose combined background of newspaper work and business management perpetuated the traditions of his predecessors.

sive and were virtually the only figures available to the trade. The first annual statistical issue under the new management lived up to the tradition already established, and added new features. The Journal boasted that it was "read by 15,000 pairs of eyes and 18 one-eyed men."

Engineering and operating articles were few in those days, but now and then one appeared, and in its news columns the Journal noted the increasing interest of the industry in improved methods, application of technology, and the work of geologists and engineers. Editorially it supported progressive movements to improve production practices, conserve oil and gas, and raise the quality of petroleum products, at times taking issue with the prevailing industry thinking on such matters.

The biggest oil news of the year—perhaps of any year—was the Supreme Court decision of May 15, 1911, holding Standard Oil Co. in violation of the Sherman antitrust law and requiring it to dissolve into competitive geographical units.

This decision was the culmination of years of litigation and more years of press and political agitation, in which Standard was pictured as an industrial octopus with tentacles in every oil activity, bent on suppressing all competitors and obtaining a complete monopoly. The Journal had stayed pretty much aloof from this fight throughout, simply reporting the important steps, now and then ridiculing some of the more extreme and baseless charges, and occasionally pointing out editorially that a considerable portion of Standard's success was due to sagacious business policies and strict economies in operation.

The dissolution decision was printed in full text in the Journal, filling 22 columns. Its editorial position was that the effect on the oil business would not be as revolutionary as many believed, predicting that "Standard will certainly adjust itself . . . and it is only timid people who can foresee any disturbance of the petroleum industry or practical commercial and industrial conditions."

Problems of publishing in the boom town of Tulsa were great, so the Journal moved to St. Louis late in 1910 in an effort to avoid delays in printing and distribution and to improve its typographical appearance. The printing job was better, but the Journal felt out of place away from the oil country and in little more than a year it moved back to Tulsa "to correct the one admitted error in the Journal's brief, but brilliant, career."

At the same time the Journal was livened considerably, with larger type, more pictures, and now and then a feature story about an interesting sidelight on the industry, but without sacrifice to statistics and field reports. By this time the Journal could boast that under the new management its bona fide, individually paid subscription list had grown 300 per cent and its advertising more than 150 per cent.

The automobile was coming into use in 1912 but teams predominated in the oil towns of the Southwest, as in this view of the main street of Drumright, Okla., a scene quite typical of the period.

8. Dawn of the Gasoline Age

The industry was ill prepared . . . but cracking saved it

THE years 1912 and 1913 were troublesome times for the oil industry, as reflected in the Journal's pages. The industry didn't know it at the time, but it was helping to set the stage for the first world war. Germany, England, France, and Russia were engaged in a vigorous race to develop oil production within their own territories or anywhere else. This was watched closely by the industry, because it posed a threat to the important export market.

But meanwhile the domestic oil market was exceeding all expectations. The demand for fuel oil was mushrooming, and to cap the climax the United States Navy finally shifted from coal to oil as a fuel. Almost since its beginning the Journal had campaigned editorially for Navy use of fuel oil, but when the step was taken it only added to the supply problem.

At the same time, refiners were troubled by the declining market for illuminating oil, heretofore the mainstay of the business, and the growing demand for "naphthas, benzenes, and gasolines." The motor age was dawning, but the oil industry was not well prepared for it.

A crisis appeared in the winter of 1912-13, when Standard Oil Co. (N. J.) began cutting off contracts to sell fuel oil. The Journal commented:

"The growing demand for gasoline and the lighter products has almost made it imperative that large refiners use all the oil possible for refining purposes . . . In order to obtain the products necessary for this demand, the refiner will be loath to part with any of his crude oil for fuel purposes . . ."

This new demand for refined products caused an increase in the number of small refineries in the Mid-Continent, and the Journal began to survey these periodically and to print considerable news on the refining branch of the industry. But the new activity could not keep pace with demand. An active search for a substitute motor fuel was begun, and when the International Association of Recognized Automobile Clubs offered a prize of $100,000 for a fuel, other than gasoline, capable of being used in internal-combustion engines, the Journal remarked, prophetically:

"It is probable that this can be discovered in the heavier products of petroleum . . . Along these lines there is more promise of obtaining a substitute for gasoline than from any other product, and if the chemists and the mechanics will work together it may not be so long before the heavier grades of petroleum may supply the autoist with a cheaper power."

At that very moment, unknown to the industry or to the Journal, exactly this was being done, in great secrecy. It was in April 1913 that the Journal noted that a new fuel, "motor spirit," was being produced from petroleum by a process developed by Dr. W. M. Burton of Standard Oil Co. (Ind.). The Journal could get no details on the process except that it involved "pressure distillation" but reported that it produced a yield of 30 per cent from crude, that the new fuel gave 25 per cent more mileage than ordinary gasoline, and that Standard had quietly begun marketing it, at 3 cents per gallon under regular gasoline, without any advance notice to its dealers.

In this manner the oil industry became aware of the thermal cracking process which saved the automobile and made it possible for crude oil to yield tremendous quantities of

high-grade products. "The ghost of an immediate shortage in the gasoline supply is laid for good and all," the Journal said, but the development threw panic into independent refiners. The price of gasoline began to decline and soon refiners were experimenting with half a dozen new refining processes promising higher yields of gasoline and a chance to compete with the patented Burton process.

A landmark in the Journal's history occurred in February 1914. It moved into its own building and began its own typesetting and printing. It was a little building on West Second Street, and the Journal occupied only the first floor, with editorial and business offices in two rooms at the front and mechanical department in the rear. But the Journal now had a permanent home and complete control over its manufacture and production. In later years the building was extended and finally made L-shaped by the addition of a larger building fronting around the corner on Cheyenne Avenue, its present address.

That summer the industry was extremely worried about overproduction of crude. Storage tanks were full, pipe lines were unable to take all that was offered, waste was almost scandalous, and the price structure was in grave danger. Observing that east of the Rockies a new well was being completed every 17 minutes, the Journal remarked:

"The drill is the heaviest load the oil industry has to carry, and unless that useful instrument is laid on the shelf for a while an improvement in market conditions cannot be expected. . . . Cessation of drilling operations is the only means of relief from present conditions. . . ."

Throughout its pages it scattered little "boxes" reading:

"Stop The Drill!"

There was something of a general business depression in the country, and a decline in industrial activity cut heavily into the market for all petroleum products. Gasoline, which a year or so before had been a premium product, was going begging at 7 cents per gallon at the refineries, and there was little talk of trying to find a substitute motor fuel. The Journal expressed its faith that times would improve and demand increase, and entreated producers to hold their oil in the ground until consumption could catch up with the capacity to produce.

That was July 1914, and the oil industry was too involved in its own troubles to take note of the Serbian assassination of the heir to the Austrian throne.

9. War in Europe

Panic and gloom . . . then a frantic urgency

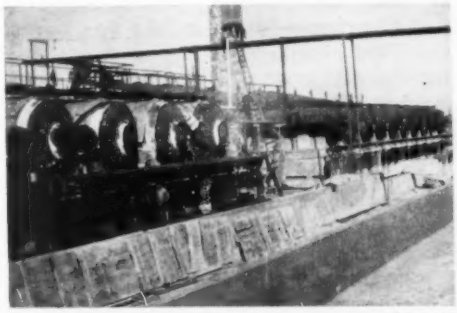
Then war came.

"The business world has been thrown into a temporary panic," the Journal said August 6. "Trading in the marts of Europe and America has been stopped. . . . Industrial activities have been checked. . . . Tank steamers are not permitted to set forth on scheduled voyages. . . . The great oil industry of the United States, at a time when overproduction is depressing prices and creating chaotic market conditions, receives an unexpected and very serious blow. . . . The utmost pessimism prevails among all oil interests. . . ."

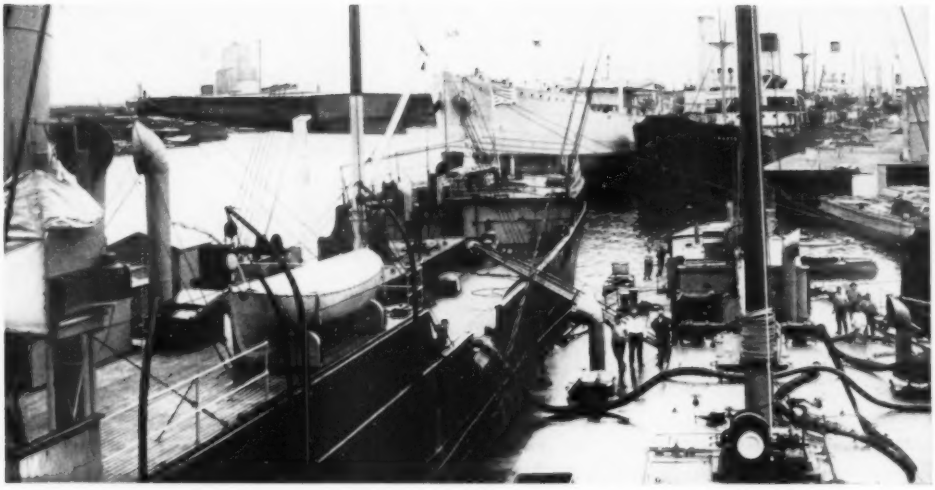
With the European market shut off, crude purchasers in eastern fields imposed a limit of 100 bbl. per day from any one producer, and in Oklahoma the pipe lines would take only 60 per cent of the production of any well.

Sentiment for a shutdown in Mid-Continent production was intensified. Groups of purchasers held bitter meetings in attempts to reach agreements. The Oklahoma Corporation Commission tried to curtail drilling and production, particularly in Cushing field, and some producers asked martial law to enforce its orders.

But the oil outlook brightened as the war news darkened. It became apparent that European production was badly disrupted by the war, and usual transportation routes were cut.



Pressure stills like this 1914 installation of Standard Oil Co. (Kans.) at Neodesha, were hard pressed to keep up with the zooming demand for gasoline.



The outbreak of World War I brought a serious threat to the vital export market for southwestern oil which moved through such busy terminals as this one at Port Arthur, Tex., shown here as it appeared about 1913.

Markets for American oil in the Orient went up sharply, and the opening of the Panama Canal gave Gulf Coast oil an entree to this new business. It was also evident that the European belligerents needed tremendous quantities of oil and that tankers could get across the Atlantic in spite of commerce raiders. War orders from abroad began to stimulate American industrial activity.

By November the Journal was able to report that the domestic oil market was stiffening, drilling was again on the increase, sales of oil equipment were improving after a period of virtual paralysis, idle workmen were being recalled to oil-field jobs, and "better days are coming."

It soon dawned on the industry that gasoline was the lifeblood of modern warfare and that the automobile and tractor were displacing the army mule. The Journal quoted a British correspondent as calling it a "petrol war," and predicted that use of the gasoline engine would expand rapidly during and after the war. There was speculation as to how long the Central Powers could hold out without access to the world's oil supplies, but in the spring of 1915 the Journal reported that Germany was making a substitute for gasoline out of coal and apparently would not lack fuel for military purposes.

Still, this situation was slow in being felt in the Mid-Continent, and many oil men predicted that when the war ended the world consumption of petroleum products would fall off sharply and remain low permanently.

The Journal editors were more optimistic, however, and urged operators to hold out for the long pull and to have confidence that peace would bring even greater dependence on petroleum. That the optimistic view was correct was demonstrated in the fall of 1915 when the price of crude started up as the result of heavy purchases by Allied and neutral powers and an increase in domestic industrial activity. The Journal reported an increase in employment in the oil fields, more drilling, and renewed activity in cleaning and reworking old wells. Products prices went up too, but by December crude was $1.20, and refiners began to complain that it was going out of sight.

A Journal survey of refining that month showed that a complete reversal had taken place during the past few months. Refiners were hard put to keep up with the soaring demand for gasoline and there was tremendous interest in new refining methods.

"The day is fast approaching," the article concluded, "when petroleum and its treatment will be understood even as other scientific mysteries of yesterday are understood today. Great is the future of petroleum. No industry offers greater opportunities to the young man of this generation."

Early in 1916 the industry began to feel the first of the "war shortages." Although the United States was still neutral it was supplying the belligerents with goods of all kinds. Sulfuric acid for refining and nitroglycerin for

well shooting were the first scarcities, but soon the Journal noted that the demand for tubing and pipe was far ahead of the capacity of the mills, and that wire rope and drilling tools were hard to get and advancing rapidly in price.

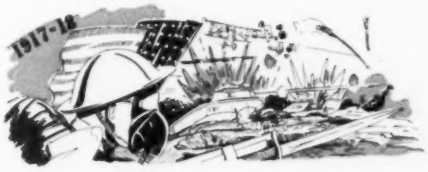
The automobile was now universally recognized as the controlling factor in the petroleum market, and the forecasts of tremendous increases in automobile production and use led to dismal predictions that oil reserves would soon be exhausted. The Journal did not agree, answering that increased drilling would provide ample oil for many times the predicted 20 years of its life, but warning that its price would go higher.

That spring gasoline hit 20½ cents in tank-car lots f.o.b. Tulsa. It was retailing for $1 a gallon in France, and many predicted that the retail price would soon be 30 cents in New York. Congress considered investigations, an export tax on gasoline, and creation of a government monopoly of the refining business. The Federal Trade Commission started a big investigation of gasoline prices and the oil industry in general, and the Journal's Washington correspondent needed several columns each week to record the charges and testimony.

Naturally this stimulated drilling in the Mid-Continent, though shortages of pipe and equipment were becoming serious. The Journal's field reporters frequently commented on the increasing reliance being put on trained geologists in locating wildcat tests. The Journal also ran many papers delivered by geologists at scientific meetings discussing the then new theories of the occurrence of oil and the best methods for locating and producing it.

This was also a period of great refinery construction in the Mid-Continent. Refineries were larger and were swinging rapidly to the use of various thermal cracking processes. A Journal survey of refining in August 1916 noted that gasoline was now the chief petroleum product with the result that the refiner was at the mercy of the market because he could not control the price of crude and must produce large quantities of fuel oil and other byproducts in order to meet the demand for gasoline. It also noted that this development had resulted in the various segments of the old Standard combine being no longer in control of the industry since independent refiners were now able to give it vigorous competition everywhere.

This new refining activity and upsurge of independence was soon put to the test of war.



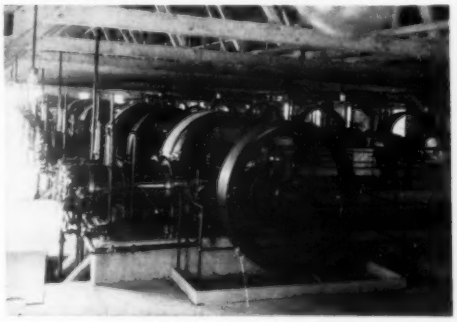
10. The First Oil War

Fighting the Government to fight for it

THE Journal Story in World War I is a story of fighting the Government for the right to fight for it, of fighting an adverse public opinion for recognition of oil as a strong and legitimate industry, and of fighting old prejudices within the oil business in a campaign to weld its segments into a unified and progressive industry.

War with Germany was declared in April 1917. The Journal immediately nailed the American flag to its masthead and rolled up its editorial sleeves to help the industry oil the war.

Some oil men feared a depression, anticipating complete loss of export markets, but the Journal forecast a big increase in demands and a big job for the industry.



The natural-gasoline industry hit its stride in the Southwest during the war, and one of the first permanent plants was this at Keifer, Okla., built by the old Gypsy Oil Co.

Effects were not long in appearing. First was a labor shortage in the oil fields. Next came a shortage of materials. Then tank cars became so scarce that refinery operations were hampered. Nationalization or government control of oil was talked. This the Journal fought vigorously, contending that the industry would meet all demands if left alone.

One of the first problems was oil for the Navy, and the industry tackled this at once. Before the war was a month old the Journal reported that a group of seven representative

Every oil town has its tale of teams sinking out of sight in the mud of Main Street, but the Journal's files yield nothing more spectacular than this typical scene of the period of the first world war.

oil men, headed by A. C. Bedford, president of Standard Oil Co. (N.J.), had met with Navy officials and given assurance that the industry would provide sufficient oil for war purposes at reasonable prices.

This small news item was destined to have great significance. For the first time, Standard and its competitors were working together and agreeing on a common purpose. It was the genesis of the National Petroleum War Service Committee which operated throughout the war to maintain oil supplies and fend off government control. And it was the start of a new kind of industry cooperation which eventually led to the American Petroleum Institute.

All three of these movements were supported by the Journal, though at times it found itself bucking strong reluctance in the industry.

When Secretary of the Navy Josephus Daniels demanded a low ceiling price on fuel oil, the Journal protested that this would stop production. But when Mid-Continent producers began a "strike" as a protest against Daniels' plan, the Journal admonished them that it was their patriotic duty to keep on producing and to depend on the War Service Committee to present the industry's position.

When the Government demanded a stop to wasteful practices in production and use of oil, the Journal plugged the conservation campaign in the face of apathy and outright opposition of many oil men, but at the same time it preached voluntary economizing measures as against the many proposals for regulation and rationing.

When the Bureau of Mines declared that there would not be enough gasoline for the war unless more cracking equipment were used, the Journal ran many long articles on new cracking processes and their installation and operation. And when Indiana Standard offered its Burton process free to all refiners for the duration of the war, the Journal praised the action and criticized those independents who professed to see something sinister in the offer.

After the Navy's initial threat of commandeering and confiscatory prices had been beaten off, the industry was in little danger of federal control for several months. In July the Bedford committee, enlarged by representatives of all segments of the oil industry, was formally made the Petroleum Committee of the Council of National Defense. This group dedicated itself to solving war oil problems by voluntary cooperation within the industry, and the Journal helped spread this gospel.

As a result of the new spirit engendered in the industry, the Mid-Continent Oil and Gas Association was formed in October, and meetings of oil men in various cities were becoming common. The Journal pointed out that this was due partly to patriotism and the need to work together during the war but primarily because the industry had become so large and complex that old competitive animosities were being forgotten and a new spirit of cooperation was arising.

It was, therefore, a shock when the Council of National Defense dissolved all its industry committees and created an oil administration

under H. A. Garfield, United States Fuels Administrator. This threatened an end to the government-industry teamwork, but the Bedford group reconstituted itself as the National Petroleum War Service Committee. It immediately met with the new oil administrator, Mark L. Requa, of San Francisco, an oil producer and consulting engineer, and was able to assure the industry that the cooperative arrangement would be continued. Requa set up a small staff, but the bulk of the work was done by the voluntary War Service Committee which by the end of the war grew to several hundred members organized into regional and task subcommittees.

This was a critical development, for at that time the Government took control of the railroads and there was public clamor for nationalization of the oil industry. The Journal continuously carried the torch for private ownership, pointing out time and again that the oil industry was investing huge sums in drilling for oil and in refining and transporting it, and that petroleum prices had been kept at reasonable levels voluntarily while the Government had put ceilings on some basic commodities and other prices had gone sky high.

This matter of price control was touch and go throughout the war. At first the industry held the line fairly well, but as demand increased many refineries began paying premiums for crude. In the spring of 1918 all distributors and consumers of fuel oil were placed under license and priorities were established, and the scramble for oil threatened to push up the entire price structure. The industry's voluntary control of prices was in jeopardy.

The crisis came to a head in July when Requa and members of the War Service Committee attended mass meetings of producers in Tulsa and Houston. Finally the producers agreed to limit premiums and competitive price boosting and set up a system for allocating crude to refineries in short supply. As a result the Government agreed to continue voluntary controls until November 1, and the Journal redoubled its pleas to make cooperation effective and denounced those recalcitrants who said that the War Service Committee was serving only the "big interests."

As the November 1 deadline approached, a serious oil shortage was in prospect and the Government again seemed on the verge of taking control of the industry. Then came the armistice on November 11. The industry was saved by the bell, but the Journal had won its fight for voluntary cooperation.

11. Postwar Power

Strength . . . solidarity . . . technology . . . prosperity

THE United States came out of the war a world power. Oil came out of the war a major industry. The Journal came out of the war a strong and recognized spokesman for United States oil.

All three were somewhat surprised by their new status and stature. None quite knew its own strength nor just what to do about it.

The nation sloughed off its war controls quickly, but the League of Nations controversy soon reminded it that it could not return to its prewar preoccupations. The Petroleum War Service Committee was no longer needed, but the group was kept intact pending formation of a permanent organization. The cooperative strength of the oil industry was recognized, and by the following spring the American Petroleum Institute was launched.

The Journal strongly endorsed the A.P.I. movement and chided the doubters who feared it would be a tool of the "big interests," hammering away at the doctrine that the industry must present a united front against its attackers and should cooperate in solving technological and business problems. It lauded A.P.I.'s first actions in attempting to curb oil-stock frauds, beginning a coordinated research program, and meeting with automobile manufacturers on common problems of fuel utilization and engine design. But it was greatly disappointed that the A.P.I. did not adopt its long-standing and oft-repeated suggestion for an industry-wide campaign of public education about the oil industry.

The general acclaim for oil's part in winning the war did much to cement the new feeling of strength and solidarity, and the Journal did all it could to foster this feeling. It pointed out how much the industry had gained through its wartime cooperation, how the old animosities between "Standard" and independents were being buried, and how technological progress had advanced the concepts of conservation in production and efficient utilization in refining.

Typical of the postwar discoveries was Burkburnett in Wichita County which brought development of boom proportions to North Texas for the first time. Development was so hectic that many field workers lived in tents.

The war had brought the industry a new realization of the importance of the chemistry of petroleum and great advances in refining techniques, and the Journal reminded its readers of the vistas of future developments from the wartime experiments.

The Journal derided the early postarmistice pessimism that the bottom would drop out of oil markets with peace, declaring that the world had entered a new era of dependence on the internal-combustion engine which meant a continually expanding demand for petroleum products. This prediction was quickly borne out, as both domestic and export demands shot the undreamed-of heights. So did the price of crude, and wildcatting increased phenomenally.

The Ranger boom was the focus of all eyes, the Bureau of Mines established a petroleum research center in Bartlesville, and oil companies did a tremendous volume of new financing. Oil had come of age, and to announce it the Journal on May 30, 1919, published a 280-page supplement, "North American Oil and Gas." This was the first publication giving between two covers a description of the petroleum industry, its geography, technology, organization, and current and historical statistics, and it did much to clear away public misunderstandings and to give the industry itself a feeling of solidarity and power.

This also was the first of a series of special editorial projects the Journal undertook to help fight the industry's battles, and the initial effort awakened the Journal as well as the industry to its new stature as the authoritative organ and aggressive spokesman for United States oil.

Like the industry, the Journal was experiencing unprecedented prosperity. It boasted that a single weekly issue often required 3 tons of paper. It enlarged its quarters and added new presses. It established correspondents in Chicago and London in addition to its already far-flung staff. "The Journal has been recognized at home and abroad as a leader," it boasted.

Oil was now a real power in the industrial world, and this fact was not lost on other nations. There began an international race for control of the world's oil resources, with England, and to a lesser extent France, challenging American supremacy. Some brash Britons openly boasted that England was out to corner the world's petroleum and bring Americans begging for oil.

This challenge was seized by the Journal at once. It exhorted American operators to extend their activities abroad, and pleaded with the United States Government for firm diplomatic support. Some voices were suggesting that the Government and the industry form a joint enterprise for foreign oil development in order to combat British aggressiveness, or that the embryonic League of Nations take charge of the world's oil reserves and apportion them among all nations, but the Journal would have none of such. Unceasingly it plugged for private enterprise, both at home and abroad, and warned against any sort of government control, national or international.

The Journal now knew it was a power in itself and the voice of a powerful industry in a powerful nation. It liked its new role, and strove hard to live up to it.

By the early 1920's the automobile was fast crowding out teams in the oil towns, as in this street scene in Breckenridge, Tex.

12. New Men, New Methods

In engineering and journalism . . . big strides

THIS new sense of power resulted in greatly strengthening the Journal's staff by a number of top-notch newspapermen who not only were steeped in the tradition of factual reporting but who also had the imagination and journalistic technique to present the facts in more interesting and readable ways.

The Journal's format underwent a series of improvements and modernizations, in keeping with the general publishing trend of the times. Articles were written in a more professional style, authors' bylines were used, the content of the magazine was rearranged for easier reading and reference, the quality of the paper and presswork was improved, there were larger and more informative headlines, and more pictures and charts.

The voluminous field reports on drilling and completions were moved to the back of the book to provide greater prominence for technical articles and news features. Refinery news, articles, and statistics were grouped into a regular department. The opening news pages were devoted to a chart of the statistical position of the industry and a summary of the highlights of the week's oil news.

In short, within a period of a year or two the Journal transformed its appearance from a drab factual record to an attractive modern magazine.

Most important of all, the Journal set out to cover all technological and engineering developments in the industry. Up to that time its technical coverage had consisted almost entirely of contributions from outside authors, but now its staff of trained reporters began digging out such information and presenting it as news. Outside contributions were continued and increased in number under the new policy. At first these technical articles came almost entirely from officials of the U. S. Geological Survey and Bureau of Mines, from a few universities with young schools of petroleum engineering, and from consulting geologists.

Apparently operating oil men of that day either were afraid to write for publication or were prevented by the policies of their companies. But before long the old attitude of secrecy broke down under the wave of technical advancements and the spirit of public information, and as the Journal became recognized as the spokesman for technical progress its pages carried more and more engineering articles from operating oil men.

At the same time the Journal's editorial

page took on much more vigor and character. The page itself was given a more prominent position in the magazine, and in outspoken words it began to forge opinion for the industry, often far in advance of the thinking of many of its readers.

The principal editorial themes of that postwar readjustment period sound familiar now but they exhibited clear thinking and unafraid speaking against the background of the League of Nations controversy, the rise of communism in Russia, the international race for world power and resources, the concern of all governments over future supplies of oil, the concentration of power in the federal Government, and the emergence of the present integrated oil corporations.

The Journal was unequivocally for private enterprise, but it stressed both words of that phrase. It fought every suggestion for federal or international regulation of the petroleum business, but at the same time it constantly urged the industry to greater enterprise in technical development, in solving its own problems, and in telling its story to the public.

The threat of British oil dominance abroad, the Journal said time and again, could be met not by the League of Nations or other international agreement, and not by government partnership with private industry, but by aggressiveness on the part of American operators to whom the country must look for assured future supplies.

The cartel movement in Europe had a counterpart in this country in suggestions from the Federal Trade Commission and others in the federal Government to "rationalize" the oil industry through various forms of regulation, but the Journal fought them all and brooked no compromise with free competition.

If the Journal had been a progressive power in the industry before, it was doubly that now.

13. Much Oil, Little Knowledge

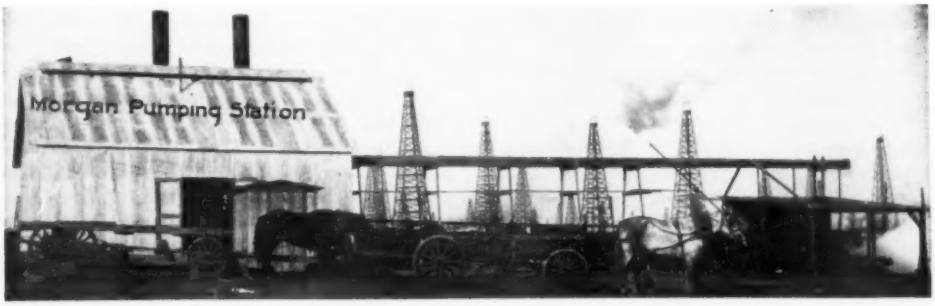
While industry groped . . . Government sniped

THE Journal Story during the early 1920's reflects the general perplexity of the American public in its attempts to reconcile the postwar conditions of the motor age with its prewar psychology as expressed by President Harding's desire to "return to normalcy."

There was little normalcy in the oil industry, and the Journal did not preach it. Instead it advocated adjustment to the new conditions and faster progress toward new horizons of thought. The oil industry had undergone a tremendous transformation during the past few years, and the Journal set about to make oil men realize the significance of this.

To those who persisted in thinking of crude production as the basis of the industry, the Journal preached that refining had become the dominant factor, the key to prices, utilization, and demand. It added a refining editor and carried a large volume of charts, statistics, technical articles, and economic discussions of the significance of refinery developments and the factors that influenced the market.

To those recalcitrants who insisted that all the troubles of the trade stemmed from nefarious machinations of the old "Standard Oil interests," the Journal preached the doctrine of "the new competition" of quality and efficiency, pointed out that strong young independent companies now held the dominant



The industry was swamped by the flush production of new fields such as Burkburnett where this picture was taken in 1920.

position, stressed that economic conditions dictated changes in prices and trade practices.

To those quick-profit producers who sought flush production from every new pool, the Journal preached conservation, proration, well spacing, the law of supply and demand, and the need for a long-range view for long-range prosperity.

To those prophets of doom who predicted an imminent oil shortage, the Journal preached a philosophy of abundance, always believing that the unfettered American oil men would be able to discover and produce enough to meet all demands.

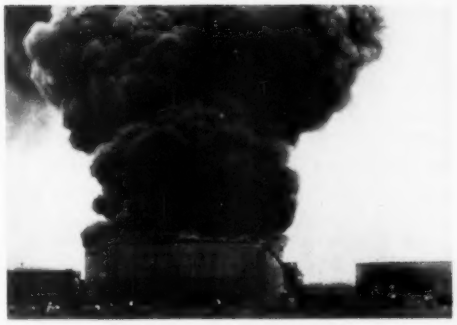
And to those who looked to the Government for the solution of every problem, the Journal preached self-reliance, free enterprise, and faith in the inherent capacity of the industry to forge its own destiny.

Three major trends in the oil industry stand out during this period of what the nation hoped was normalcy—technology, overproduction, and political attack. The Journal Story largely revolves around these three.

Science came late to the oil industry, but in the years following World War I it came fast. The Journal undertook the role of its herald, its handmaiden, and its chronicler. Issue after weekly issue during this period it not only reported new technological developments and engineering applications, but it also explained their significance. When Mid-Continent crude prices were shifted from a flat-field basis to a gravity scale, the Journal explained the economic effects and the resulting need for efficiency in refinery operations. When large companies established regular engineering departments, the Journal described them and showed how research and technical knowledge were being applied. When interest in conservation lagged with the end of the postwar crude scarcity, the Journal explained how scientific drilling and producing practices bring efficiency and economy.

By 1923 the settled production of the Mid-Continent had become the balance wheel of the oil industry, and Tulsa, now a city of 100,000, undertook to clinch its claim to being the "Oil Capital of the World" by staging an annual International Petroleum Exposition and World Oil Congress. The Journal saw in this first and in subsequent oil shows two things far more significant than boosting its home town.

The first was the opportunity to bring home to the oil industry the tremendous advance of science and technology and the debt owed



Oil fires made spectacular news pictures for the popular press before improved technology controlled this and other causes of waste.

to the developers of the new equipment for exploration, drilling, producing, transporting, and refining petroleum and its products. The Journal worked diligently to make the exposition not a mere equipment fair but an institution for scientific education and technical progress.

The second byproduct did not occur to the Journal until after the first oil show was held. This was the remarkable opportunity it offered to educate the general public about the oil industry. The Journal was astonished at the crowds of curious laymen who flocked to the exposition grounds, but, unlike some of the exhibitors, it was not annoyed. Here, it said editorially, is proof that the public knows nothing of oil but very much wants to know, proof of its old contention that the public will understand oil if oil would only tell its story. This lesson was not forgotten by the Journal, but at the moment its major attention was given to a more immediate problem.

A short but severe business recession occurred a couple of years after the armistice, and this marked the end of the crude-oil bonanza. Production not only had caught up with demand, it had exceeded it. Crude prices dropped and storage mounted. Then began a long and heart-breaking series of attempts to curtail production to something approximating market demand. At that time it took the form of field-wide shutdown movements and regional agreements to curtail offset drilling or the completion of new wells. These failed for lack of cooperation or under threat of antitrust prosecution, and when pipe lines were forced to prorate their runs there were cries that the "big interests" were squeezing out the independents.

For all this the Journal had one consistent

explanation: Production cannot long exceed consumption without causing trouble. It pleaded with the industry to watch the economics and statistical position of oil, and to work out some sort of method for preventing ruinous periodic overproduction, insisting that the laws must be construed or amended to permit this in the name of conservation and common sense.

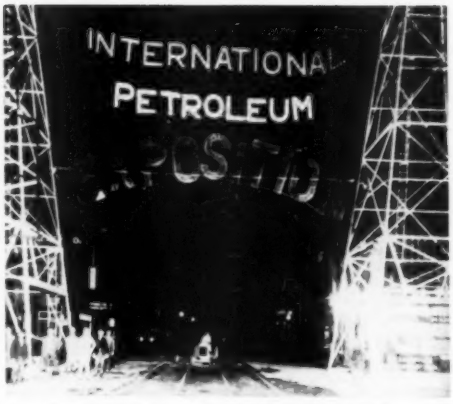
But the Journal was not content with the negative approach of curtailed production. The real solution, it said, was increased consumption. It urged refiners to do less competitive advertising and raiding of each other's outlets and to get together to promote automobile touring, good roads, mechanized farming, and other things which would increase consumption.

It did more, too. A special article analyzed the chaotic condition of the fuel-oil market and concluded that a tremendous demand could be developed for home heating. What was needed, the survey said, was standardization of grades, assurance of a continuous supply at steady prices despite fluctuations in refinery activity and the gasoline market, and development and promotion of a safe, efficient, and foolproof home oil burner. It suggested that the oil industry's technicians develop such a burner jointly and that the entire industry promote home heating with oil as a means of enlarging and balancing its market.

This theme was echoed and reechoed in the Journal's editorial pages over a period of years, together with many other suggestions for cooperative efforts to stabilize and expand the demand for petroleum products. But the Journal was ahead of its time, a voice crying in the wilderness, a prophet without honor. Nothing came of this campaign.

Despite the overproduction of crude and a consequent weakening of refined-products prices, the public was obsessed with a fear of an "oil famine" and an "oil monopoly." The high cost of living was a chronic complaint, and politicians were quick to make oil the scapegoat. Adverse legislation was introduced in Congress and many state legislatures, and the industry was subjected to a rash of investigations.

In Washington the fire-eating Progressive Senator LaFollette began a witch-hunting investigation which threw consternation into the industry, but the Journal counseled that the industry need have no fear of the facts but only of a misinformed public opinion. Again it took up the cudgels for public education and pleaded with the A.P.I. to underwrite a program in defense of the industry. For its part, the Journal established full-time editors in Washington and New York in order better to report both government and industry opinion and activities.



The late James McIntyre, Journal editor, 1921-1934, and his brother, the late Ed McIntyre, were largely responsible for inaugurating the International Petroleum Exposition in 1923 at Tulsa. Ed McIntyre was the first general manager.

But the industry kept mum about itself, and in March 1923 the LaFollette committee filed a blistering report full of such charges as that the entire industry was controlled by Standard Oil Co., that it could not long survive without government control, and that the price of gasoline would soon reach $1 per gallon.

This was too much to take. The Journal immediately denounced the LaFollette report as unfair, prejudiced, and silly, and called on the industry to answer it with facts. A few oil men did so, but without apparent effect, so for months the Journal ran article after article exposing the absurdities of the LaFollette report and answering its charges with facts and figures.

For months also it ran strong editorials pleading with the industry to answer the political attacks, to present a united front, to educate the public, to form a central clearing house for economic and technical information. It urged oil companies to use their advertising for defense of the industry instead of for brand promotion, to make their service-station attendants into missionaries of public education, and to enlist every motorist in a campaign against government control. It railed against "political interests which appear to look upon the oil industry as only something to loot," and warned that "the public clamor for joyriding on profitless gasoline spells ruin."

Succeeding oil shows, as in this 1948 view, were used by the Journal to point out the industry's advances in technology and its debt to the developers of advanced equipment for all operations.

14. The Answer

A voice is found . . . with fruitful results

THE death of President Harding in August 1922 coincided with the start of the investigation of what current publicists insist on calling the great oil scandals of Teapot Dome. Muckrakers had a carnival, and it is hard to say whether Harding's name or the oil industry's suffered worse. Harding was dead and defenseless, and it appeared that the oil industry would soon be the same. The nation was admonished to "Keep Cool With Coolidge," but the Journal could not keep cool. It was boiling over.

It warned that the Teapot Dome investigation would not be confined to the Navy's handling of its petroleum reserves but would turn into a general denouncement of the entire oil industry. All that fall and winter, with all the language and logic it could command, it urged, pleaded, exhorted, the industry to get together on a statement in its defense and give it wide public circulation.

Then LaFollette climbed aboard the Teapot Dome bandwagon with a bill for federal dismemberment and control of the oil industry. Everybody agreed that the industry faced the gravest crisis in its history, but nobody did much about it.

Nobody but the Journal. It decided to practice what it preached. Single-handedly it became the defender of the industry.

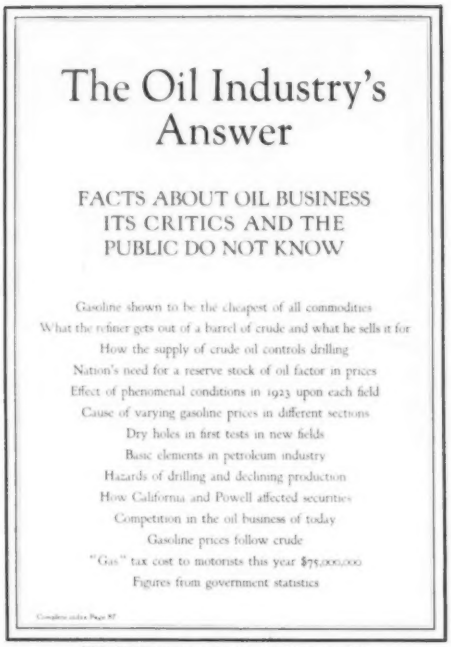
Its defense took the form of a 69-page special section in the issue of March 20, 1924, entitled "The Oil Industry's Answer."

This was a staff-written job, tailored to the needs of the hour by skillful journalists who knew what the public and politicians did not know about oil and how half-truths about the industry were being twisted against it. For the first time, all pertinent information about the oil industry was collected in one place and presented in simple language, replete with charts, statistics, and illustrations. It was a real textbook on the economics of petroleum as well as a defense of the industry's practices and performance. In language anyone could understand it explained the hazards of drilling for oil and the market instability caused by flush pools, and hammered home the theme that gasoline is the cheapest of all commodities.

The Oil Industry's Answer was a bombshell. It aroused the industry as nothing had ever done. Here at last was something oil men could use. The way to action was clear.

Within a few weeks more than 120,000 copies of The Oil Industry's Answer, reprinted as a 100-page booklet, were distributed by oil companies. Copies went to every congressman and senator, every state official, and the editor of every daily newspaper.

But the Journal did not rest on its laurels. It campaigned to get oil men to use the ammu-



The Oil Industry's Answer

FACTS ABOUT OIL BUSINESS
ITS CRITICS AND THE
PUBLIC DO NOT KNOW

Gasoline shown to be the cheapest of all commodities
What the refiner gets out of a barrel of crude and what he sells it for
How the supply of crude oil controls drilling
Nation's need for a reserve stock of oil factor in prices
Effect of phenomenal conditions in 1923 upon each field
Cause of varying gasoline prices in different sections
Dry holes in first tests in new fields
Basic elements in petroleum industry
Hazards of drilling and declining production
How California and Powell affected securities
Competition in the oil business of today
Gasoline prices follow crude
"Gas" tax cost to motorists this year $75,000,000
Figures from government statistics

REPRINTED FROM THE OIL AND GAS JOURNAL, TULSA, OKLA.

The industry's public-relations program started in 1924 with this series of Journal articles. Distributing more than 120,000 reprints of this fact-packed booklet, oil companies hit back at their critics with great success.

nition it had supplied. It particularly urged that the information be put into the hands of the 15 million owners of automobiles, preferably through filling-station operators. Not content with this, the Journal showed how to do it.

First it made what was then a unique experiment—a public-opinion poll. Its extensive editorial staff interviewed a large number of filling-station operators in all parts of the country, asking a series of simple questions about the oil industry. The answers revealed an amazing ignorance about the most elementary facts of oil, and clearly showed the need for dealer and public enlightenment.

Then it began a series of weekly one-page articles entitled "Short Talks to Motorists," giving essential facts about the industry in brief paragraphs of popular language and illustrated with drawings in the comic-book technique. The Journal's material was used by many oil companies in general advertising and for dealer-education programs. Industry leaders drew on the "Answer" material for speeches and public statements. It was as though the industry had suddenly found voice after a protracted paralysis.

Praises rained in galore, and one executive wrote the Journal: "Nothing has ever been done which accomplished so much for the unification and solidarity of the industry—it has made each branch of the industry see that all must go up or down together."

That fall the A.P.I. launched a public-relations program which the Journal hailed as the culmination of its long editorial campaign.

The Oil Industry's Answer was bearing fruit in the industry and it also was bearing fruit with the public. The LaFollette control bill fizzled out, and at least one threatened state investigation was called off by the governor with the explanation that the Journal's booklet had given all the desired information.

The Journal knew it was winning its fight for better understanding of the facts of the oil industry when President Coolidge, late in 1924, appointed a Federal Oil Conservation Board, composed of a group of his cabinet members. This board set out to make an objective study of the industry with the view of developing constructive legislation.

Here at last, said the Journal, was a dispassionate, helpful investigation as contrasted with 13 previous federal investigations of the oil industry, all of which had been prejudiced. It gave the new board the fullest cooperation in obtaining facts about oil and urged the industry to do likewise, and it chuckled in high glee when the Senate stopped an incipient oil investigation by the Federal Trade Commission on the ground that the Coolidge Board should do the work.

The Journal was now riding high, wide, and handsome. The tremendous acclaim and positive results of The Oil Industry's Answer gave it enormous prestige and a sense of power and leadership. It used this power and leadership in many ways.

Throughout this period the Journal was constantly expanding its editorial services and its appearance. It began running a rotogravure section of oil-industry pictures from all over the world; it strengthened its departments devoted to refining, natural gas, markets, new equipment, and other phases of the industry, and it ran an increasing number of articles on technology, economics, and management.

Better statistics and their wider use by the industry had always been a favorite project, and in 1924 the Journal hired for its staff the director of statistics of the A.P.I. That year its annual statistical number was the most complete it had ever published, containing a wealth of charts and interpretative articles.

Market Value of Cracked Gasoline

Chemical Composition and Boiling Range of Product Obtained From High Pressure Distillation Responsible for Its Superior Motor Fuel Characteristics

By E. H. Leslie
Professor of Chemical Engineering, the University of Michigan

Two personages of extraordinary importance to the petroleum industry and to the motorist have quietly been at work for some time improving petroleum technology. One of these, friend Cracking, not long ago a mere infant in arms, has become a sturdy youth who now asserts his majority and entire capacity to carry his share of the work of the day. The other, Improvement in Distillation Technique, although of maturer years and well tried at ... work, has not ... together ... good ... in the ...

DR. LESLIE SAYS:

"At one time high gravity gasoline was the thing. Now the proper attitude is 'the lower the better' provided the volatility is O. K. With proper volatility, low gravity means the presence of olefinic and cyclic compounds—the very substances that confer anti-knock properties on the gasoline.

"Cracked gasolines contain large proportions of olefines and naphthenes, and in many instances moderate amounts of aromatics. The ... dominate ... of these substances probably are units for a good share ... [illegible]

confronted with the necessity of drawing conclusions from few data. However, it is well established that the paraffin hydrocarbons are much worse knockers than the olefines, naphthenes, or aromatics.

Well established, also, is the fact that volatilities being equivalent, cracked gasolines of all descriptions are not such bad knockers as the gasolines distilled directly from the crude. To be fair, comparisons should be made between ... [illegible]

A series of Journal articles like this one broke down the popular but unfounded prejudice against cracked gasoline and opened the way for a rapid growth in use of the cracking process.

15. The Dawn of Reason

From technological discoveries . . . a constructive approach

THE last half of the 1920's was a period of remarkable growth in the oil industry's understanding of itself, and the Journal had no small part in advancing this march of science and reason.

For the most part, business was good and the industry was prosperous. The political climate was favorable, for instead of threatening interference and control the federal Government aided the industry through the research of such agencies as the Federal Oil Conservation Board, U. S. Geological Survey, Bureau of Mines, and Bureau of Standards.

Against such a background the industry made great strides in the development of better equipment, exploration methods, refining efficiency, pipe-line construction, application of geology, understanding of reservoir behavior, development of secondary-recovery methods, legal and engineering experiments in unitization of oil pools, and in many other ways.

In all these the Journal took the lead, and the development of the several branches of the industry as told in its files was the basis for most of the other chapters in this volume. But not content with merely recording technology, the Journal also led in pointing its application for the betterment of the entire industry by explaining and urging its use.

In its first issue of 1925 the Journal noted that crude production had declined 2 per cent during 1924, the first reduction since 1906. This, it said, is not a foretaste of an oil shortage but a spur to further wildcatting and an opportunity for the industry to stabilize its operations and to improve its efficiency in conservation and utilization of oil. It followed this up with several articles on technical methods of increasing production, avoiding waste, and sec-

April 28, 1927 THE OIL AND GAS JOURNAL

A Challenge to the Oil Industry

Overproduction Must Be Regulated by Co-operation or Government Supervision. Leaders Should Develop Plan

Tulsa, Oklahoma,
April 21, 1927.

To The Oil and Gas Journal:

The oil industry with a world-wide and almost unlimited market for its products is as a whole losing money.

Not less than ten billion dollars are invested in the petroleum business. No other such sum is at the mercy of such unstable conditions as is the oil business. The iron and steel industries, subject to the vicissitudes of the demand, manage to maintain prices that result in an adequate return on the investment. The cotton industry is advised and urged by the Government and public opinion to curtail its production so that profitable prices may be obtained. The tobacco industry, the lumber trade, the packing business and the ice cream concerns feel means of adjusting their production so that no large amount of unnecessary finished products are flooding their markets. The oil industry alone appears incapable of helping itself.

Is it because the executives of the large oil companies cannot see where the trouble lies or do they lack the willingness to get together as leaders of other industries do?

Is it because the petroleum industry has been so intimidated by official restraints and threat of prosecution that oil men are afraid to attempt to use the remedies that other industries have applied?

We have recently experienced situations which with proper spirit and co-operation would have saved the industry from its present chaotic state and in each case the fear of government prosecution has restrained leaders from taking the necessary steps to conserve this wonderful resource.

If fear of government prosecution is the real reason must it be continued indefinitely, regardless of the disastrous results that will follow with obvious loss to those who have invested their money in it? These investors include the leading financial, industrial and commercial interests in the country. Is there any other investment which would be permitted to continue to run along under such conditions without an effort being made to correct it?

The Government is demanding conservation of our oil resources and at the same time is putting its finger in the proverbial pie for those who would attempt to put into effect practical means of conservation which would result then, large or small, to carry on operations on a reasonably profitable basis.

Oil men hesitate to get together to discuss industrial problems lest they be charged with the violation of the anti-trust laws. No such fear seems to have possessed the leaders of the steel industry or executives in other industries who meet in conference and exchange information which permits them to operate their business with regard to supply and demand and thus escape the repeated depressions that bring the oil business to the door of bankruptcy.

The opinion seems to prevail that anything done to restrict output will be a violation of the anti-trust laws. If this is true is it not just as much a violation of the law to eliminate competition by causing the failure of many small units as a result of the confusion brought about by overproduction? Ultimately the public must pay the cost.

E. B. REESE
President Ramsey Corporation

The oil industry is facing the most critical condition in its history because of production without regard to demand. Is it to be a "survival of the fittest" or will the leaders do those things which are necessary to correct the situation?

Wasteful duplication in marketing outlets exposed by C. B. White in an economic indictment of the business sense of the industry.

We have been warned that by continuing the present methods the outcome must be one of two things: Co-operation or government supervision. If the industry does not want the one it must accept the other.

Cannot The Oil and Gas Journal open its pages for a discussion of the situation with a view of developing a plan which will overcome recurring situations like the present wasteful and almost criminal dissipation of this admittedly most important natural resource?

E. B. REESE

This famous letter brought the Journal credit for launching the industry on a new era of cooperation for conservation.

Technical Questions Answered

By DR. C. K. FRANCIS, TECHNICAL EDITOR

Cracking Processes

Kindly give a list of the cracking processes now available which are suitable for handling topped crude. H. S. C.

We cannot discuss the patented processes but if you will supply your complete address we shall be pleased to furnish the names and addresses of the agents who are handling the major processes now on the market. They will be glad to explain all details.

Lubrication

What is meant by the wedge action of a lubricating oil?—R. B.

The term is involved in the theory and practical application of lubrication. A flat stone may be thrown on the surface of a pool of water so that it will skip along the surface. It does not sink because it pushes forward faster than it can thrust the water aside in sinking. A high-speed motor boat following the same law throws its bow well above the surface and a wedge-like wave may be observed beneath the bottom. The lubricating oil on a bearing behaves in the same manner. The faster the bearing moves, the higher the wave or wedge.

Corrosion

The ells between our manifold and mufflers in the condenser box do not last us one week. What causes this?—T. S.

Probably [illegible] form from [illegible] gases. It has been determined, hence destructive distillation.

Fullers Earth

Can the value of fullers earth be found by analysis?—J. T.

Not by chemical analysis. Fullers earth is used for decolorizing and this power should be determined by comparison with a sample of known value. The test may be made with 100 to 1,000 c. c. of the earth in a small laboratory filter, and the oil run through, either to a definite color or until the earth is exhausted, as indicated by no change in the color of the oil used. The quality of oil obtained from the unknown earth, when compared with the volume obtained from the known earth, indicates the value of the sample.

Absorption Gasoline

What is the influence of temperature when absorbing gasoline from gas?—B. C. N.

At a constant pressure the quantity of gasoline absorbed varies with temperature. Increasing as the temperature is raised and increasing as it is lowered. The industry is abandoning the practice of going to very low temperatures, because a more stable product is obtained by using normal temperatures and applying pressure.

Treating

[illegible] for kerosene made [illegible] is bleed of [illegible] gas [illegible] if placed in the sun. Can you explain this?—T. W. A.

No. You may improve conditions if you add more acid but the trouble may be due to the character of the stock from the pressure stills. Too high temperature or too much of the pressure kerosene in the blend. Give us more details.

Coal Distillation

What are the substances obtained when distilling coal?—D. M.

Coke, tar, benzol, ammonium sulphate and gas are the chief raw products.

Heckmann Tower

What is a Heckmann tower?—J. D. R.

This is a fractionating tower of the bubbling type originally used in the sugar industry. The design and action is the same as the tower now used in gasoline plants and refineries.

Benzol

What is benzol blend?—V. E. S.

A mixture of benzol and gasoline, usually 50 to 50 per cent. Benzol is the foundation or starting point of a great series of substances, and as the principal source is coal tar, these substances are known as coal tar or benzol derivatives. From 1.3 to 3 per cent is obtained from coal when making coke. When pure it boils at 176 degrees Fahrenheit, however the commercial article is not pure, so [illegible] final boiling [illegible] may [illegible] as high as [illegible] degrees Fahr. [illegible] is diluted [illegible] with gasoline [illegible] to prevent knocking. The carbon from benzol is not as hard and close-grained as that formed from gasoline, so may be blown out of the motor easier.

Geophysical Instruments

Articles in The Oil and Gas Journal relating to recent developments in locating oil by means of instruments, do not explain the actual means. Give a description of their use.—G. H. C.

Although this question has no direct bearing on the manufacturing end of the oil business a brief description of the instruments will probably be of interest to refiners and natural gasoline manufacturers. The instruments, the seismograph and the torsion balance, are not oil finders. They are scientific instruments which serve in determining the nature and position of rocks beneath the surface. They have been used with success in locating salt domes.

The seismograph is an instrument designed to record an earthquake shock. The simplest form is a cup of molasses. The wave of molasses raised by the tremor registers itself by a stain on the side of the cup. The scientific instrument registers by means of delicate pointers tracing lines on smoked glass or prepared paper. The direction, violence and duration of the movement is indicated by the lines traced.

The torsion balance is an apparatus [illegible] for [illegible] house [illegible] of [illegible]

It was during the 1920's that the industry began to make wide use of science and technology, and the Journal led the way by adding engineers to its staff and publishing a large number of engineering articles such as this feature which has been a regular department for a quarter of a century.

ondary recovery, to show how modern methods could refute the charges of waste which were then alarming much of the public.

That spring the Journal did another piece of pioneering research in compiling a large map of the oil sands of Oklahoma and an extensive article on the geology of the region. It explained that such a necessary aid to conservation should have been provided by the federal Government instead of the unreasoning attacks on the industry, but since such fundamental information was not available elsewhere the Journal had compiled it as a public service.

The Journal's campaign for knowledge and reason showed results in two steps which the American Petroleum Institute took in 1925, both long advocated by the Journal. It started a modest public-relations program and a coordinated program of research into producing methods and prevention of waste. These enabled the A.P.I. to present a good case for the industry before the Federal Oil Board, and the Journal claimed credit for laying the groundwork for this.

During 1924 and 1925 the Journal's strength and leadership were shown in the start of its program of special numbers devoted to a single phase of the industry. Its first International Number appeared in December 1923, followed in ensuing months by special issues on pipe lines, refining, natural gas, West Central Texas, California, and other producing regions.

These specials were usually accompanied with wall maps in several colors, and they contained coordinated information on statistics, economics, and technology of the section of the industry under scrutiny. When the A.P.I. held its 1926 convention in California, the Journal sponsored special trains from the Mid-Continent for the convenience of oil men.

By this time the march of science had made such strides that the Journal's regular reporting staff had difficulty keeping up and interpreting the developments for the industry, so in 1926 it began adding petroleum engineers to its editorial board. Thus strengthened in its technical understanding, the Journal undertook to lead the industry in application of the fast-growing volume of scientific knowledge. Among other notable efforts, it ran a special issue on corrosion prevention, made the first survey of cracking plants ever compiled, ran a series on secondary recovery, began a department of answers to technical questions, printed a special issue on standardization of oil equipment, and opened its columns to a running debate on unit operation of oil pools.

The big oil story of 1927 and 1928 was the investigation by the Federal Oil Conservation Board and general concern over conservation, and the Journal was right in the middle of it.

The board held its first hearings in February 1926 and the Journal carried a full report by wire as a contribution to the industry. Editori-

ally it said the hearings showed that the industry could solve its conservation problems itself if permitted to do so, and it urged both Government and industry to give financial support to basic research into production and secondary recovery such as was being done by the Bureau of Mines. The fact that the press played up the charges of waste made at the hearings again demonstrated the need for the industry to have a central public-relations program which might have had the industry's side of the controversy ready to present at the same time. As the investigations progressed, the Journal kept insisting that the greatest service the board could perform would be to remove legal obstacles to cooperative action by the industry and to foster research and dissemination of factual information.

That fall the board's first report found that the federal Government lacked power to regulate production but suggested state legislation to require unit development based on correlative rights.

The Journal viewed this skeptically. It feared a rash of unwise, even socialistic, state laws. A better plan, it felt, was legalization of voluntary agreements among producers in the interest of conservation.

So again the Journal took the initiative. First it interviewed Secretary of Commerce Herbert Hoover and got from him a recommendation that the antitrust laws be amended to foster cooperative conservation practices. Then it interviewed Assistant Attorney General William J. Donovan, head of antitrust enforcement, and wrung from him an admission that the laws might be interpreted to permit this.

These suggestions failed to spur the industry to action, so the Journal took another big step. Under the name of E. B. Reeser, president of Barnsdall Oil Corp., appeared an open letter calling for industry-wide discussion of plans to prevent "the present wasteful and almost criminal dissipation of oil," and concluding that the industry cannot continue to be operated without regard to supply and demand and it must either regulate itself or be regulated by the Government.

This brought results. The Reeser letter got nation-wide attention, and for weeks the Journal's pages carried comments from the industry's executives, engineers, and lawyers. A committee of industry leaders met with federal officials to work out a program, and the A.P.I. recommended state legislation to secure uniform practices in preventing gas waste.

The Journal was credited with starting the industry on a new era of cooperation, but it did not rest there.

Big oil discoveries following the war brought a wave of speculation in oil stocks, including such curbstone brokers as these in Breckenridge, Tex. The Journal, which got its start combating fraudulent promotions, again took up the cudgels for sound financing and factual representations.

In December 1927 Congress and many state legislatures had before them a huge volume of oil-control bills. The A.P.I. was meeting in Chicago. The Journal sensed another crisis point in the industry. So it repeated its coup of 3 years before.

It printed another special section entitled "The Oil Industry's Answer Today," giving a great volume of facts in lay language, designed to be used by industry witnesses in testimony and for public education, and based on the theme that the industry was at work to prevent waste and overproduction through the application of new scientific knowledge and that it could achieve far more than either state or federal laws.

Significantly, the A.P.I. adopted the Journal's plan, and began working for state laws permitting operators to agree to curtail production to avoid waste. That same week the Federal Trade Commission reported on an 18-month investigation of the oil industry and found no evidence of monopoly or unfair practices but noted a growing spirit of cooperation within the industry. The Journal crowed loudly over this vindication of its campaign.

The Journal crowed, too, about its own new building, and about its world-wide news coverage and the great volume of outstanding technical, engineering, and operating articles it was presenting to the industry.

Van field in Van Zandt County, Texas, discovered in 1929, was typical of the boom towns brought by new discoveries and of the flood of flush production which burdened the oil industry even before the depression hit other industries.

16. The Great Depression

To stop a flood . . . martial law

FOR most industries the Great Depression dates from the stock-market crash in the fall of 1929, but the oil industry was suffering months earlier. All that spring and summer the Journal had been warning that the industry must do something to curtail production because stocks of both crude and refined products were increasing tremendously. It predicted a depression unless there was real curtailment.

But in November, when the market crash had the country on the verge of panic, the Journal tried to be optimistic. It pointed out that oil securities had never been inflated, that oil properties were not overvalued, that oil was virtually depressionproof because of a continually expanding market; it said that now that the industry had learned how to stabilize production and keep it in line with market demand the outlook for the coming year was very good.

This prediction went sour almost immediately. Within a few weeks prices of crude and products hit a toboggan. A special train of Mid-Continent producers went to Washington to demand a tariff on foreign oil. The Federal Oil Conservation Board endorsed the Journal's suggestion for Sunday shutdowns of refineries and producing wells.

The Journal said that the oil industry is the most optimistic on earth but this is a drawback because it had led to underestimating actual conditions and to temporary rather than long-range views. It predicted a long and severe depression and said temporary shutdowns must be replaced with a consistent and definite program for keeping supply in line with demand.

All during 1930 and 1931 the oil industry went from bad to worse. Production kept far ahead of demand, and prices dropped to ruinous levels. The industry got exactly nowhere in its efforts to find some way to stabilize itself.

By December 1931 conditions reached crisis proportions. The enormous flush production of East Texas and Oklahoma City fields could not be absorbed by an already oversaturated market. The governors of Texas and Oklahoma attempted to shut down these fields, resorting to military force and martial law to enforce their orders. Kansas, Oklahoma, and Texas formed an oil states' advisory board to attempt to allocate production, and the Journal said that the once-rejected idea of an interstate oil compact might be the solution and should be given careful consideration by the industry.

Industry leaders and state and federal officials agreed that production and refinery activity must be based on market demand, and several studies were started to this end. This was hailed by the Journal as acceptance of its long campaign for better statistics and better use of them by the industry, and it predicted an early solution now that all parties were agreed on the problem.

But more was needed than an abstract objective, and results did not materialize. So again the Journal took the lead.

In April 1932 the Journal conducted a poll of opinion among industry leaders and reported

ROBERT W. EGAN

These men made major contributions to the editorial policies under which the Journal has achieved preeminence as a technical publication and a leader of industry opinion. Robert W. Egan was vice president and general manager from 1921 until his death in 1928. He pioneered in promoting wider use of engineering and of public relations by the oil industry. C. O. Willson joined the staff in 1922, was refinery editor from 1923 to 1936, and has been the editor since. He has emphasized the international as well as domestic phases of petroleum with frequent trips to operating centers throughout the world by himself and other staff members.

C. O. WILLSON

that the cause of the industry's troubles was the competitive race to produce, wasteful methods of extraction, and failure of the law of supply and demand to operate effectively. It concluded that the root of the trouble was a fundamental error in the legal status of oil, and recommended the adoption of a legal theory of ownership-in-place instead of the old law of capture.

This was followed for months with a series of articles and editorials advocating unit operation of oil fields to be accomplished through changes in state laws, conservation regulations, and interstate cooperation by regulatory agencies. It developed the unitization concept into a detailed program for stabilization of the petroleum industry, saying this would result in reduction of government supervision. It insisted that "legalized piracy" was the basis of overproduction, and cited opinions of prominent lawyers that the unit method could be made legal.

All during 1932 the Railroad Commission of Texas was engaged in a series of legal contests with operators in East Texas in an attempt to halt overproduction in the name of conservation. The Journal called on the industry to help prevent "bootlegging" and "theft" of oil produced in violation of commission orders, but at the same time it realized that the commission was on the wrong track.

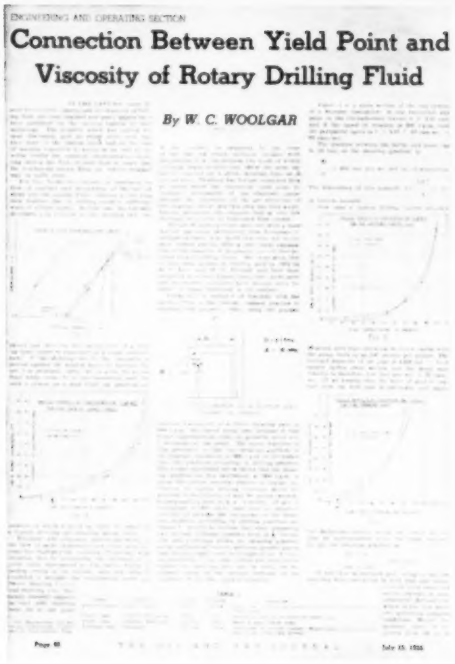
That summer the Journal's engineering staff reported that the natural water drive in East Texas was the clue to proper proration, and said that if the commission would base its curtailment orders on maintaining bottom-hole pressure it would have a method which would be legal, sound from an engineering standpoint, and which would result in a big curtailment of production and greater ultimate recovery of crude. A series of articles outlined the technical and legal bases for state proration based on reservoir engineering and control of bottom-hole pressures, and the Journal began a campaign for regulation based on engineering principles rather than on political influence or arbitrary limitation to raise price.

Late that year Texas made an attempt to control East Texas by regulating bottom-hole pressures, but its enforcement was ineffective. The flood of crude was so great that many in the industry advocated abandoning all attempts at curtailment in order to let East Texas and other flush fields run out in the hope that things would cure themselves in time.

But the Journal would have no part in such counsel. It continued to plead with the industry to cooperate with state officials in perfecting a system of proration which would be sound on both engineering and legal grounds.

Amid this general attitude of despair the New Deal came into the Washington scene.

A Journal staff man snapped this view of his car on the "main highway" through Winkler County, Texas, a typical scene in this area in the late 1920's.



ENGINEERING AND OPERATING SECTION

Connection Between Yield Point and Viscosity of Rotary Drilling Fluid

By W. C. WOOLGAR

ENGINEERING AND OPERATING SECTION

Oil Bearing Formation Characteristics Yield Vital Data on Repressuring

By KENNETH B. BARNES*

As the industry began to emerge from the depression the Journal greatly strengthened its technical services, printing more articles by its own staff and by leaders in the industry, which were grouped into a regular illustrated section every week.

17. The Blue Eagle

Under federal control . . . Ickes

NO sooner were President Roosevelt and his cabinet sworn in than things began to happen, in oil and everywhere else.

The new secretary of the interior, Harold L. Ickes, immediately called a conference and accepted the recommendation of state officials and industry leaders that the President order all flush fields shut in for 2 weeks and to request all states to enact strict conservation legislation and give federal assistance in their enforcement. The Journal praised this program as showing the industry the way out of its morass.

But the New Deal began to exhibit the divided counsel and shifting policy which marked its entire course. Others in the administration had different ideas. President Roosevelt rejected the Ickes recommendation and instead called for divorcement of interstate pipe lines from ownership by oil shippers. At the same time one wing of the administration supported bills pending in Congress and several farm-state legislatures to require blending gasoline with alcohol made from surplus grain.

Enraged but undaunted, the Journal tore into both these crackpot schemes with all the vigor it could muster. It began a series of articles, which continued for several months, pointing out technical objections to the "alky-gas" proposal. It also ran a series of articles against pipe-line divorcement, starting with a compendium called "The Facts About Pipe Lines" which it urged the industry to broadcast as it had used The Oil Industry's Answer.

At the same time the Journal tried to write East Texas out of the picture. Under political pressure the Railroad Commission set a very high allowable, and the Journal said this would soon get rid of flush production and put the entire East Texas field on the pump within a short time. But this proved to be wishful thinking. The new high production dropped crude prices to 10 cents per barrel in East Texas, and 25 cents in the Mid-Continent. The Journal railed that such an exhibition of incompetence was an open invitation to federal control, and this time it was right.

In May Secretary Ickes drafted a bill to make himself dictator of the oil industry, and some industry leaders were inclined to welcome it. The Journal tore its hair. Temporary troubles should not blind the industry to the dangers of federal control, it cried; East Texas will pass away in time but government regulation would be permanent; the real danger is not East Texas or a dozen flush pools but dictatorship.

Congress shelved Ickes' bill, not on its merits but because it was writing the omnibus National Industrial Recovery Act. The act did include an amendment to prevent interstate shipment of "hot" oil.

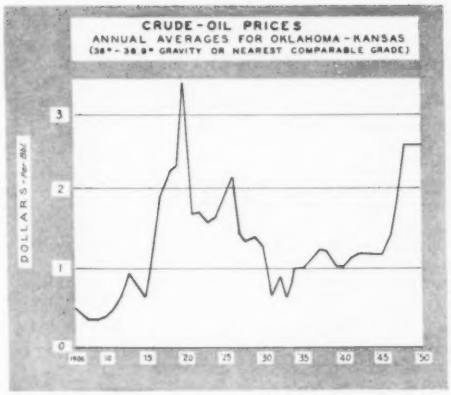
The NRA oil code went into effect in September with Ickes as administrator. The Journal tacked the Blue Eagle to its masthead and urged the industry to concentrate on making proration work and to postpone arguments over price fixing and the many other details of the controversial code. The industry failed to heed the advice, and Ickes suspended the price-fixing provisions of the code, a step the Journal applauded, saying proration would restore the law of supply and demand and price fixing would then take care of itself.

The oil code had a hectic life. Month after month, Ickes, the industry, and state officials wrangled about its provisions and its administration. Time and again the Journal denounced the hot-oil runners and pleaded with the industry to concentrate on a scientific basis for proration and forget other details of the code.

By the spring of 1934 things had got so bad that Ickes drafted, and Senator Thomas of Oklahoma introduced, a bill to supplant the NRA oil code with permanent federal regulation of the petroleum industry. The Journal must have been badly discouraged, for its first reaction was pretty much "serves you right"; it said federal control of the oil industry had been made necessary because state regulatory bodies had abdicated states' rights by failing to enforce proration regulations.

During much of this period the Journal was busy with its own affairs and in seeking new ways to serve its readers. Its International Number in December 1932 included a foreign-language catalog of American oil equipment printed in English, Spanish, French, and Russian.

In August 1934 it marked the seventy-fifth anniversary of the Drake well with a Diamond Jubilee Number containing a 266-page special section which it called the first complete history of all branches of the oil and gas industry. This section was reprinted as a separate booklet and was widely distributed.



Depressed and fluctuating prices, the Journal kept saying all during the 1930's, could be corrected only by sound production and conservation policies developed and administered cooperatively by the industry and state commissions.

By this time Congress was becoming wary of accepting ready-made New Deal legislation, and it put off consideration of the Ickes oil-control bill pending investigation of the oil industry by a House committee headed by Rep. William P. Cole, Jr., of Maryland.

It was September 1934 before the Cole committee began serious consideration of the Ickes bill, and by this time the Journal had had its fill of federal control. Using the hardest-hitting language of its career in a two-page editorial headed "Back to Work," it said:

> "The time has come to declare definitely that we have been off on the wrong foot. Unless the industry pulls itself together and retraces its steps it is likely to find itself in a federal strait jacket. . . . The Oil and Gas Journal, like the industry at large, has given wholehearted support to the federal administration, hoping against hope that a solution of the crude problem might be found. But it becomes increasingly clear that the administration has abandoned hope of stabilizing the industry short of putting it in such a strait jacket in every department. On that program we part company. A pioneer in the movement to keep crude production down to demand, The Oil and Gas Journal had consistently and persistently warned the industry of the danger of federal control. It was only when effective state regulation in Texas seemed impossible, that federal assistance, not control, was welcomed by the industry. That assistance was sidetracked from the real purpose, crude regulation, and has been wandering up and down dead ends ever since. . . .
>
> "Like the rest of the country the oil industry had got so low during the 4 years of depression that it almost despaired of recovery. The dramatically staged rescue took on all the glory of an apocalyptic vision. Everything had failed us but Washington and the impulse was to turn everything over to Washington, including the oil busi-

ness. But, in the case of the oil industry, experience has shown that Washington has been unable to produce the promised land. . . . The industry now finds itself wrapped up in an endless tangle of regulations and restrictions, subject to an unceasing flood of questionnaires and reports and so generally badgered by official supervision and interference that it has barely time to attend to its business. . . .

"Federal control once riveted upon the neck of the industry will never be removed. It will become the prey of politics and the haven of bureaucracy. . . . The day may come, sooner than now expected, when the need will be for new production instead of curtailing existing fields. The industry in a federal strait jacket will wish it had kept its freedom, but it will be too late. The oil industry will be as barren of opportunities for initiative as the postoffice. . . .

"The only remedy that has not been tried has worked well in other cases. That is joint effort by the federal and state governments in oil-producing states through an interstate compact. . . . The advantage of this plan would be that its constitutionality has already been established. It involves no departure from American principles, no regimentation of the industry, no strait jacket. . . . The example of governmental interference in the oil business has been a demonstration of its utter inability to cope with modern business problems. . . . Putting the industry in that sort of a harness would be worse than 10 East Texas fields."

All fall and winter the Journal continued its vigorous editorial campaign against federal control and for self-regulation, and it augmented its editorials with weekly cartoons drawn exclusively for it.

Its efforts met success. In January 1934 the Supreme Court invalidated the hot-oil section of the NIRA and the Cole committee recommended against federal control in view of this decision and the efforts of oil-state governors to form a compact. The Journal commented that these encouraging developments opened the way for effective state regulation.

Its statistical issue that month showed that the industry was in far better shape than it had been for several years, and said this should give the industry the courage to turn its back on Washington and look to its future in its own activities and resources.

There was not long to wait. Late in May the Supreme Court invalidated the entire NRA, oil code and all.

The Journal ripped the distasteful Blue Eagle from its masthead and shouted:

"Industry and business can again breathe freely. . . . The threat of federal control is ended. That in itself should be a stimulating influence, although for the moment there may be some confusion during the process of readjustment. Since the code brought no advantages its elimination can cause no disadvantages. . . . The constructive forces of the industry can continue their labors to stabilize the business."

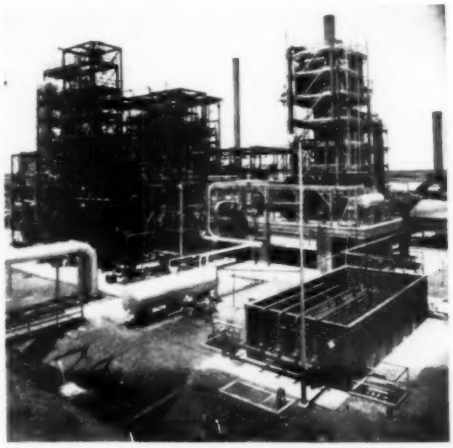
18. Peace for a While

Some problems . . . some progress

FOR several years after NRA the Journal and the industry shared troubles and triumphs. There were a number of crises, but they were minor in comparison to what had gone before and what was to come. Business improved slowly for both, and both reflected it in better service.

The Journal continued to make improvements in its editorial staff and in its format. It adopted a better grade of paper, more modern type styles, improved layout practices, and grouped all technical articles into an engineering section labeled as such. In December 1935 it printed another of its special reports on the industry, this one a 24-page section on the industry's record and contributions to the nation's economy without federal regulation. Its International Number that year ran 312 pages, and included another four-language equipment catalog.

The Journal's special numbers were greatly improved in quality. In March 1936 it had a 208-page Refinery Engineering Number, and



Much large and efficient refining equipment was installed during the late 1930's, as in this plant of Atlantic Refining Co. at Atreco, Tex., which went on stream in 1937.

Refining technology was advancing rapidly, and the Journal aided the movement by such editorial services as this special issue of March 19, 1936. During this period the Journal devoted its major efforts to improving the engineering practices of all branches of the industry, and at the same time it converted itself into a sprightly modern magazine by improved format and typography and new methods of graphic presentation.

in September a special section on the growth of the diesel engine.

The first complete and detailed report on proven reserves ever printed anywhere was compiled by the Journal staff and included in its Annual Statistical Number in 1937. Its editorial said this removal of the mystery in estimating new reserves was a contribution to the basic information of the industry and a natural development of the increased knowledge of producing formations. The Journal followed this up with a series of articles on the changes in exploratory methods needed to keep reserves adequate to supply a rapidly increasing demand.

Under the Interstate Oil Compact Commission, state regulation of conservation was making steady progress during this period, but from time to time the Journal felt impelled to admonish the state agencies that conservation should be more than mere weighing allowables against nominations and should not be used merely to control prices but should be based on fundamental engineering principles of reservoir control and with a view of the industry's over-all and long-range economic position.

The federal Government did not let the industry alone by any means, and during these years the Journal carried many discussions on such developments as Federal Trade Commission investigations and rulings, the Social Security Act, federal wages and hours law, the National Labor Relations Act and the spread of the union movement in the oil industry, possible ramifications into the oil industry of the federal controls developed under the Guffey Coal Act, Agricultural Adjustment Act, and the Tennessee Valley Authority, the Robinson-Patman Act, state chain-store taxes, and the Iowa plan of operating filling stations.

Antitrust was a constant threat. The Madison indictments charged virtually the whole industry with conspiring to control gasoline prices by continuing a buying pool which the Government had requested under NRA. The Journal again called for a campaign of public education to prevent such defamation of the industry's character, and again asked for government sympathy for industry efforts at self-regulation.

Instead, the antitrust division was put in charge of the "trust busting" Thurman Arnold, who began his tenure by threatening a new series of oil prosecutions and proposed that gasoline marketing be made a public utility. The Journal called this the unmasking of the socialistic trend in the administration.

Bills to divorce marketing and pipe-line operations from integrated industry operations got considerable support in Congress. The first of many bills asserting federal claims to tidelands oil was pressed. The coal industry demanded a federal tax on fuel oil, and the

reciprocal trade agreement with Venezuela cut the tariff on petroleum imports. All these were, on the whole, only minor irritants. The oil industry continued to make tremendous technological progress, and the Journal's reporting kept pace with it. Likewise the industry expanded its operations to new areas of the world, and the Journal also expanded its international news coverage.

Late in 1938 two Washington developments gave the Journal cause for alarm. Sen. Joseph C. O'Mahoney of Wyoming proposed federal licensing of interstate corporations — which looked like a return of NRA—but which soon developed into a somewhat scholarly investigation of industrial problems on a broad front. At about the same time the National Resources Committee, a New Deal agency, issued the first of a series of reports calling for federal control of the oil industry.

During the ensuing months the Journal welcomed the TNEC investigations as an opportunity for the oil industry to tell its story before a national forum, and it was well satisfied with the way in which the industry did this.

But the Journal could see no good in the NRC proposals. It called the first report the most important document since NRA and said it put the industry on notice that the Government will take over unless the industry and the states cooperating can settle their difficulties.

This warning proved correct. In the summer of 1939 President Roosevelt asked Congress to enact a federal oil-control bill based on the latest NRC report, a volume entitled "Energy Resources and National Policy." This went to the Cole committee which soon began hearings amid Journal thunderings that the industry had one last chance to forestall the regulators.

The producing end of the industry was again in deplorable condition that fall. Overproduction was chronic. A series of court injunctions had frustrated many state attempts at proration and each was followed by a new flood of crude and a new drop in its price. Oil-state governors held special meetings, operators tried voluntary shutdowns, and for a short period the flush pools in six states were closed in at one time.

The Journal could do no more than repeat its now-familiar but still unheeded admonitions that the industry must base its operations on its over-all statistical and economic position, that the oil states and the industry must cooperate, and that proration must be founded on sound engineering and legal principles.

19. War Clouds Again

Harassment gives way to cooperation . . . in emergency

AS the fourth decade of the century drew to a close the oil industry was beginning to learn the value of cooperation and the application of engineering principles in solving its problems. Conservation regulation by the oil states was making its first halting steps toward what was to become effective control of waste and widely fluctuating production.

But in Washington federal officials looked askance at industry cooperation and could see no hope in state action. The pressure for federal control continued undiminshed.

In the midst of this, World War II began in Europe, but for many months it had no appreciable effect on the American oil industry. The Journal warned that war demands for oil would not pull the industry out of its hole, but it sighted new possibilities of federal control in the President's proclamation of emergency and his neutrality and defense program.

As 1939 gave way to 1940, the principal war effects were marked development in catalytic cracking facilities, chiefly because of the interest in aviation gasoline, which spurred the octane race in motor fuels. A "moral embargo" was imposed on the export of high-octane refining equipment. The Journal's International Number that December was dominated by discussions of the oil resources of the warring nations.

That spring hearings started on the Cole bill for federal oil control, and the Journal sounded the tocsin for the industry to take the offensive, and when governors of the oil states joined the industry in opposition the Journal hailed it as a historic event. The industry's statements of its position before the Cole committee and the TNEC were termed by the Journal a complete answer to federal regulation, but it called on the industry to finish the job by telling the story to the public.

That summer German armies swept across the Low Countries and drove through France. The President sent his preparedness message to

Congress and organized the National Defense Advisory Commission to plan for mobilization. The industry cooperated with the Defense Commission in planning facilities to produce toluene, synthetic rubber, and aviation gasoline, but in the midst of this, and despite NDAC opposition, the administration filed the so-called "Mother Hubbard" antitrust suit charging the A.P.I. and all major oil companies with a series of illegal practices covering virtually the whole range of the industry's operations.

This suit was denounced by the Journal in a two-page editorial, and showing the depth of its feelings as the November election approached it departed from its usual policy of ignoring party politics to warn editorially that continuance of the administration through a third term for Roosevelt would make federal control of oil virtually a certainty.

During the spring of 1941 oil began to feel the approach of war. Foreign trade was channeled by Lend-Lease and export licensing. A priorities system for steel and other scarce materials was set up, and the Journal complained that this did not provide enough steel to sustain drilling at the rate needed to supply the increasing demand.

This 1940 discovery of new pay in the 20-year-old K.M.A. field of Archer County, Texas, was typical of the new technology and deeper drilling applied during this period and which resulted in finding new producing zones in many areas of formerly small production.

The Government took 50 of the industry's tankers to lend to England, and supplying the Atlantic Seaboard states became a serious problem. Two gasoline pipe lines were projected across the southeastern states but they were blocked by coal-carrying railroads which refused to grant right-of-way until Congress enacted legislation giving pipe lines the right of eminent domain.

On June 1 a bombshell burst. President Roosevelt created an Office of Petroleum Coordinator for National Defense, and put Secretary Ickes in charge. The Journal was stunned. Here was its old antagonist, Ickes, personification of federal control. But it urged the industry to cooperate in the interest of national defense. Ickes called a general conference of industry leaders and pledged to withhold all his reform and control ideas. The Journal applauded this and the ensuing actions of the industry in setting up district committees to work out the increasing number of industry problems.

Germany invaded Russia, economic sanctions were placed on Japan, and war moved closer. The East Coast suffered a gasoline shortage in spite of coordinated industry attempts to supplant its lost tankers with special movements by rail and pipe line. Congressmen were furious at the shortage and there were several investigations of the oil industry and of the Office of Petroleum Coordinator.

The priorities system underwent a series of changes but none of them assured materials for oil operations. To assist amid the confusion, the Journal began a weekly question-and-answer service on priorities.

The Office of Price Administration and Civilian Supply was attempting to prevent inflationary prices, and one of its first targets was oil. The industry complied with the OPACS requests to postpone several scheduled increases in both crude and products prices pending study, but the Journal complained that these studies never terminated and higher prices were justified to insure an ample supply and to cover higher costs.

By fall the OPC had perfected its organization and the Petroleum Industry Council for National Defense, composed of three-score leaders of the industry, was called to hold its first meeting in Washington on Monday, December 8.

On Sunday bombs fell on Pearl Harbor.

Named for the founder of The Oil and Gas Journal, this tanker was launched during World War II.

20. The Great Oil War

For herculean tasks . . . a historic team

THE story of oil in World War II is told in detail in many published works. The Journal Story during World War II is tragically reminiscent of the Journal Story in World War I. Again it found itself fighting the Government for the right to fight for it, and fighting a critical public opinion which blamed the industry for all shortages.

But the Journal had more help this time, and made progress, particularly with the second problem. The industry had learned the necessity for cooperation and publicity, and was better organized to achieve both. The way all segments worked together as a war-oil team was a classic. And the industry's governmental boss, the Petroleum Administration for War, so well understood its problems that it helped defend it against all investigations and complaints.

The oil industry is prepared for any and all war demands, was the Journal's theme in the months immediately following Pearl Harbor. The Journal believed it, and so did the industry and the Government. But again optimism proved to be a weakness.

By spring the Journal was complaining that Washington did not realize the size of the oil job in the war. By summer it was warning that oil's equipment needs were being ignored in administering priorities. By fall it was shouting that the industry could no longer live off its fat, that military demands were mounting rapidly while oil was denied the steel to expand beyond prewar size.

As its war job the Journal undertook to guide the industry in anticipating the problems which developed in disheartening succession and to assist it by giving full information on the confusing administrative orders and the rapidly developing technology.

The Government's system for handling priorities and allocations to apportion scarce supplies of steel and other materials underwent a continuous metamorphosis throughout most of the war, and the many war controls were administered by a large and frequently changing group of agencies designated by a bewildering array of capital letters. The Journal carried column after column of spot news and interpretative articles explaining the meaning of all this to oil operators and throughout the war it ran a weekly "War Orders Digest" to assist the industry.

Confusing as the administrative side was, greater difficulties were encountered in keeping the industry informed on the mad race of technological progress in refining techniques for the production of 100-octane gasoline, synthetic-rubber components, and petrochemicals for munitions and other war uses. Censorship and security regulations at first were applied rather indiscriminately to almost all process information, statistics, and even plant locations and descriptions in the oil industry.

This was a direct conflict with the Journal's historic campaign to get the industry to make better use of both technical and statistical information. Its wartime philosophy was that real military secrets should, of course, be kept, but that the enemy already knew much of what some government officials tried to suppress and that supplying other information to the industry would do our war effort far more good than it would do the enemy. Throughout the war the Journal had to walk a tightrope between national security and an informed industry.

The "Big Inch," or War Emergency Pipe Line, shown here crossing the Arkansas River, was rushed to completion by an industry-government team to supply the Northeast when coastwise tankers went to war. It dramatized the feasibility of long-distance, large-diameter pipe lines for both oil and gas.

In spite of this, and with the cooperation of government men who realized that the industry must have the facts, the Journal was able to continue its accustomed services and to publish technical articles on all but a few of the newest and most confidential developments in refining and petrochemistry.

The first spring of the war the Journal's refining number was devoted to petroleum war products and petrochemistry. This was followed with a special issue on wartime maintenance of equipment during the period of materials scarcity. That fall it started a series of technical articles on petrochemical production.

The biggest single effort to help the industry do an entirely new war job was a special synthetic-rubber issue in November 1942. The hastily improvised program to offset the loss of natural-rubber sources to the Japanese had settled on petroleum as the major source of raw materials and it was evident that many new plants must be built and new processes perfected. By a prodigious reporting job the Journal rounded up a great volume of unpublished technical information on the production of butadiene and synthetic rubber from petroleum and printed a volume which did much to clear up confusion and assist refiners in advancing the program.

The next spring the Journal got out a special "Wartime Refining" issue, and followed up with a series of technical articles on conversion of plants for the production of 100-octane gasoline or its components.

The Journal's trained staff was decimated by the loss of men to the Armed Forces, but it managed to recruit other workers and even to strengthen its staff of engineering writers. Early in the war it started its service on "Engineering Fundamentals" as well as several other regular features on technical subjects which have been continued since, and its general coverage of the industry's technology actually increased during the war despite censorship and manpower problems.

The greatest mechanical change since the Journal became a weekly took place during the war. For 30 years the Journal had always used a large page size. The publishing trend, however, was toward a smaller size and the Associated Business Publishers, of which the Journal was a member, recommended a standard size for all business papers. The Journal had been contemplating such a change for some time, and the war hastened the decision. It took months to restyle the magazine's format, revamp and augment its mechanical equipment, and get ready for the new style. The change took place with the first issue of January 1943. It was an immediate success. Readers were high in their praise of the new format, and while some professed a nostalgic affection for the big page size they all agreed that the smaller, standard page had greater utility.

The timing of this change was most fortuitous because just at that time paper became so scarce that the Government imposed quotas on all users. Since the new size required less paper, the Journal was able to keep within its tonnage quota without curtailing its services to the industry.

Another step forward was taken during the difficult conditions of 1943 when the Journal launched a companion publication, Petroleo

Cycling became an important phase of the Southwest's oil industry starting about 1938. This is a postwar view of The Texas Co.'s Bateman Lake plant in Louisiana.

Interamericano, a bilingual publication chiefly for the junior engineers and workers of oil operators in Latin America. In doing this the Journal had the blessing and support of government officials because the United Nations needed all the oil which could be produced in this hemisphere and the new publication was an important instrument in training efficient workers in this rapidly expanding activity.

The Journal's new staff was kept humping all through the war to report and interpret the kaleidoscopic developments in government agencies, priorities, manpower controls, price controls, materials shortages, tank-car allocation, tanker diversion, gasoline rationing, tire rationing, and other war-born problems—plus the almost continuous congressional investigation of charges that the oil industry was falling down on the job.

The public could not understand why first gasoline and then fuel oil was short, nor why the petroleum industry could not turn out any desired quantities of aviation gasoline and synthetic rubber overnight. The standard reaction was to charge that the industry was sabotaging the war program for some ulterior reason and the Government should take over.

So the Journal crusaded for more public education about the industry's problems and how it was meeting them, and for more cooperation and fewer arbitrary controls on the part of Government.

First, diversion of tankers to war service caused an oil shortage and gasoline rationing on the East Coast, and the industry was blamed for this even though it was spending millions to reverse and interconnect its pipe lines and ship by tank car. A congressional investigation reached the notable conclusion that the trouble was a "shortage of surplus."

Then the rubber shortage threatened nationwide gasoline rationing to save tires. With its big-money market imperiled, the industry launched a huge scrap-rubber collection drive and a tire-conservation program, but rationing was imposed and again oil got the blame.

Soon the synthetic-rubber program bogged down. There were wild charges that the oil industry was deliberately stalling in an attempt to get a complete and permanent "monopoly" on this war-born industry. The Journal urged a public-relations campaign to tell the facts to the public, but it took a full-dress congressional investigation to make it clear that the trouble lay in the Government's programing and its priorities system and in the competition for scarce materials among the aviation-gasoline, ship-building, and other programs.

Before long military requirements were taking huge but unpredictable quantities of petroleum products, and the unscheduled demands continually upset the industry's delicate planning. For many years the Journal had been preaching the value of statistics, and now it demanded that the military make known its requirements far enough in advance for the industry to prepare to meet them. This finally was achieved through a committee of the Petroleum Industry War Council which obtained the military figures in confidence and combined them with civilian-demand forecasts to produce monthly schedules to which the industry geared its operations.

One way or another the industry solved all its war problems except one—price control. Before Pearl Harbor the Office of Price Control had requested the industry to withhold all price increases for study, and when the war started all oil prices were frozen at prewar levels. There they stayed throughout the war, with only a few minor adjustments. In vain the Journal, the industry, the PAW, and a large part of Congress pleaded that the freeze caught oil prices at an abnormally low point, that costs of production had risen sharply, and that productive capacity could not be maintained without earnings for reinvestment.

The oil industry came out of the war with its producing reserves low, its plant facilities scrambled, and its markets disrupted. But there was universal praise for the way it had done its war job, and its standing with the public, though still less than ideal, was probably the highest in its history.

21. Postwar Problems

Expansion . . . an astonishing demand

POSTWAR planning for the oil industry started long before the war ended, and at times threatened to interfere with war work.

The big hitch was that most of this postwar planning was being done for the industry by the people outside the industry, chiefly government officials. And the industry did not like the plans which others were preparing for it. Neither did the Journal.

The first suspicions were aroused in the summer of 1943 when a little information began to leak out about a mysterious Petroleum Reserves Corporation, a federal agency sponsored by the secretary of the interior with vague powers which looked broad enough to take over a large part of the oil industry.

The Journal attacked this immediately in an editorial demanding that private initiative be given a chance to rehabilitate and replenish the world's oil supplies when hostilities ended.

Through a coincidence, the inability of the federal Government to administer an oil operation was strikingly demonstrated that same summer when a congressional investigation forced disclosure of the colossal Canol fiasco in which the Government expended tremendous sums of money, manpower, and critical materials in developing a small oil field, a long pipe line, and an inefficient refinery in arctic Canada—all of which proved to be of no value whatever during or after the war.

Nevertheless Secretary Ickes pushed ahead with grandiose plans for his PRC. He proposed to take over underground reserves of the American concession in Saudi Arabia and build a pipe line to the Mediterranean.

New fears were raised early in 1944 when Ickes and the State Department negotiated an oil treaty with England. Ostensibly this was a plan for harmonious cooperation between the oil industries of the two nations in developing oil properties throughout the world, but to the Journal and a large part of the American industry it looked like a disguise—or at least an entering wedge—for government control of the oil industry both abroad and at home.

A National Oil Policy Committee was formed by leaders of the industry to make a study of PRC, the Anglo-American oil agreement, and the entire subject of postwar relations between the Government and the industry. This group recommended a constructive national policy based on government encouragement of private ownership and initiative.

But PRC and the Anglo-American pact died hard, and they remained threats for a couple of years after the war. Both were finally abandoned after a long and heated Senate investigation which ended with endorsement of the program of the National Oil Policy Committee and general approbation of the industry's methods of operations.

Meanwhile other postwar planning was in progress. The Journal made its contribution in a special issue in November 1944 outlining the industry's job as to retool, replenish, and rehabilitate, and presenting a mass of statistics on the economic problems ahead.

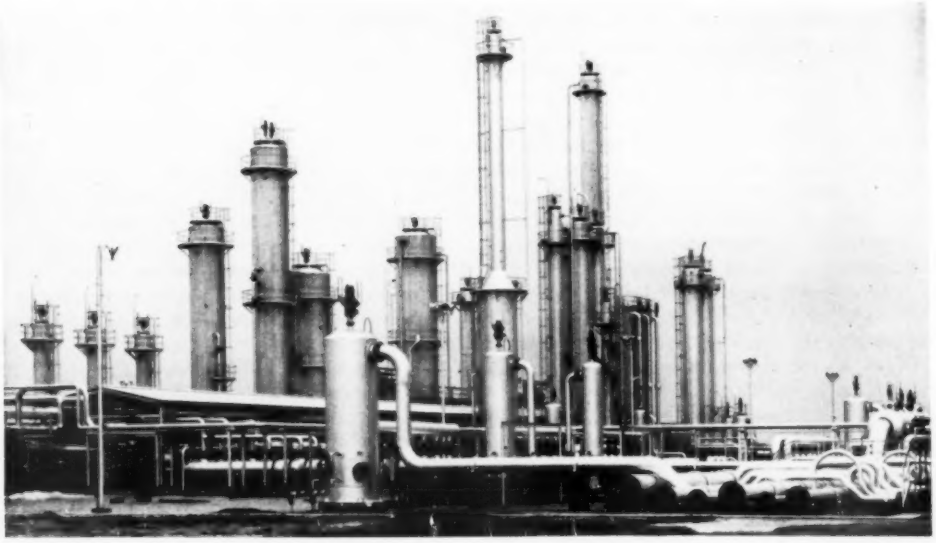
But other people were more interested in political aspects of reconversion, and immediately after the Japanese surrender in August 1945 these problems came to a head.

The first issue was dropping wartime controls, and this was a struggle. The Government insisted on keeping a tight rein on the nation's economy during the reconversion period. PAW disintegrated rapidly, but price controls persisted for a full year.

Disposal of surplus property turned into a battle royal. Strong elements insisted that the Government retain ownership of such war-built facilities as synthetic-rubber plants, aviation-gasoline refineries, and the Big-Inch pipe lines. Others wanted them privately operated but under various complicated formulas to prevent "monopolistic control." Delay in setting policies for disposal of government-owned tankers and high-pressure tank cars likewise disrupted industry operations for months. Congress investigated all these and similar matters, amid much fanfare and confusion, but eventually most of the petroleum facilities were sold and this threat of government ownership faded out.

But others arose simultaneously. While the industry was still fighting for the death of Petroleum Reserves Corp. and the Anglo-American oil agreement, the Federal Power Commission began investigating the natural-gas industry, the Government began legal action to get title to offshore oil operations, and the Department of Justice attempted to

The rapid construction of a series of long-distance transmission lines for natural gas which came immediately after the end of the war opened huge new markets for southwestern gas.



New markets for natural gas and for light-hydrocarbon liquids brought tremendous expansion of the natural-gasoline industry in the early postwar period. This Seeligson plant at Premont, Tex., was among the first of the very large ones put in operation after the war and was representative of the big construction program which followed.

revive the war-shelved Mother Hubbard suit against the A.P.I. and all major oil companies.

It was the middle of 1946 before the industry got its stride in reconversion. Price control ended, permitting a moderate increase in crude prices and the normal flexibility in the entire price structure, and encouraging new investments and new projects. Skilled men were returning from the services and materials were obtainable though still scarce and made more so by the government program to assist in the rehabilitation of foreign areas.

The Journal did some reconverting also that year. With paper more plentiful and its staff rebuilt and enlarged, it rapidly expanded its size, its services, and its circulation. It carried more news, more pictures, more color, more statistics, and more technical articles. It paid special attention to postwar refining developments—the growing octane race, the many new catalytic processes, and the intriguing field of petrochemistry.

The years 1947 and 1948 were bustling ones for the oil industry. Demand grew by leaps and bounds, far outreaching all forecasts and putting a terrific strain on the industry. Production, refining, and transportation facilities could not be expanded fast enough to keep up, and fuel-oil shortages during severe winter weather brought another congressional investigation, another "oil shortage" scare, and a new threat of government control.

Foreign operations expanded rapidly, leading to a controversy over import policy. Several long-distance natural-gas lines were started, and the Federal Power Commission's investigation came to a head amid proposals for more government control of the natural-gas industry. In vain the industry fought to secure legislation curbing FPC attempts to gain control by stretching the interpretation of its basic law. State regulatory authorities, alarmed at the threat, ordered conservation of flare gas and caused the construction of many cycling and natural-gasoline plants.

While many in Government were crying "oil shortage" the industry was expanding rapidly in every direction. Offshore development was begun in the Gulf of Mexico and the great West Texas and Scurry County fields, to mention but two, were discovered. Refineries expanded, utilizing the wartime catalytic processes and facilities and developing new ones, and moving heavily into the new field of petrochemicals. Many long-distance natural-gas lines were built out of the Southwest, and output of light hydrocarbons became an industry in itself.

And the Journal expanded with the industry, adding more staff men, more technical and engineering material, and more services for the industry. Among other things it still further enlarged its statistical and economic studies, and from this came an interesting and instructive episode.

For several years the industry had been unable to keep up with the astonishing increase in demands for its products, and by late summer of 1948 the public was alarmingly looking forward to still another year of fuel-oil shortages. But the Journal took a good look at its statistics and announced boldly "The Oil Shortage is Over."

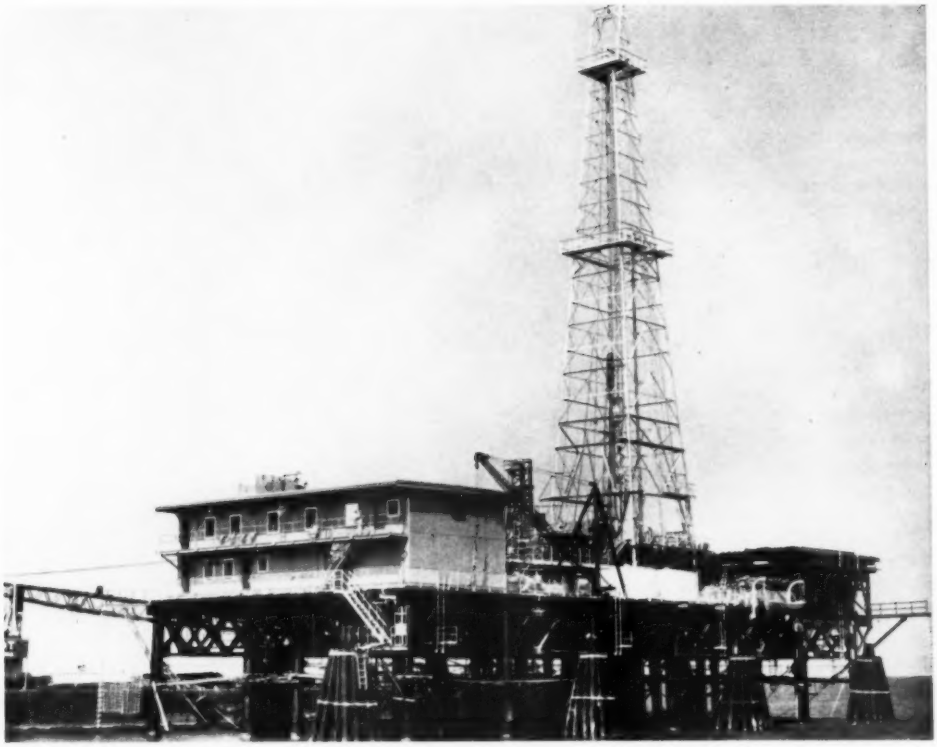
The general public was electrified, and the industry was dumbfounded. Many oil economists couldn't believe it. But the statistics and their interpretation were right, and before many weeks it was evident that the Journal's prediction was correct.

There was a brief letup in the industry's mad race to expand, but only long enough for it to catch its breath. By the middle of 1949 it was clear that further expansion would be needed. And within another year the industry faced the possibiliy of oiling World War III as Red Communism took to military aggression in Korea and the United Nations undertook to stop it.

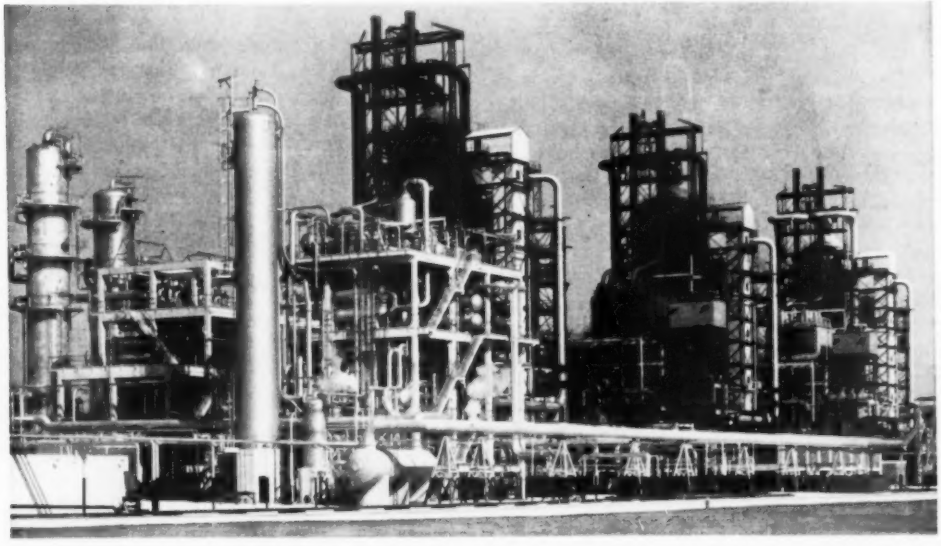
So with 50 years behind it, the oil industry of the Southwest went into 1951 facing the now-familiar problems of wartime controls, shortages of materials, and the insatiable market of Mars. But it did so with far greater confidence than before, for in those five decades it had brought to a maturity its technology, its understanding of economics, its spirit of cooperation, and its self-assurance, all achieved, in no small part, through the guidance of its "Big Yellow Bible."—The Oil and Gas Journal.

Top of the World

The Oil and Gas Journal was the biggest magazine in the world during 1949 and 1950, measured by number of pages of advertising carried. The compilation is made annually by Advertising Age. In 1950 the Journal carried 6,432 pages of advertising. This compares with 4,423 pages carried by Saturday Evening Post in 1950, and 3,814 pages carried by Life. This record is not only an achievement for the Journal but a demonstration of the size of the petroleum industry and the market it offers to manufacturers of equipment and suppliers of services of all types. It is this volume of advertising which enables the Journal to employ a large editorial staff to report and interpret industry developments all over the world.



Postwar advances in drilling included heavy drilling rigs capable of making hole faster and reaching greater depths, and also the development of techniques for using such rigs in the open waters of the Gulf of Mexico.



Giant catalytic crackers, like this battery in the Cities Service refinery at Lake Charles, La., typify the war and postwar program of refiners to meet the tremendous growth in demand and to improve motor-fuel quality.

"And so to bed." Early every Wednesday morning of the year, the Big Yellow Book takes its final form on this modern assembling and binding machine (partially shown) in the Journal's own plant where all mechanical and manufacturing operations are conducted.

22. Golden Anniversary

"What is past is prologue"

FIFTY years is a long time in the life of an industry or a publication. The southwest oil industry bears little resemblance to the forest of wooden derricks and earthen reservoirs on Spindletop mound. But it still has that which made it great—initiative, resourcefulness, and the spirit to try new things.

The Oil and Gas Journal bears little resemblance to the tiny publication which sprouted among the Spindletop derricks. But for 50 years it, too, has kept that which made it great—editorial integrity, factual reporting, and crusading leadership.

The Journal Story has a sameness running through many of its chapters, but it is a wholesome and solid consistency. Through good times and bad, and with many changes of staff, the Journal never wavered from its original vow to tell the truth and nothing but the truth. Through continual evolutions in its content and appearance, its publishing policy adhered to these major principles—to report the current news of the industry, to compile accurate and complete statistics, and to present full technical and engineering information.

And always it went beyond its reportorial function to be the voice of the industry and to mold opinion. Consistently through five decades the Journal campaigned for honesty and fair dealing, for private enterprise and initiative, for better use of economic and technical data, for viewing petroleum as a single integrated industry, and for better understanding of oil on the part of the general public.

With this Golden Anniversary book, the Journal enters its second half-century of service to the industry, proud of its past, confident of its future, and pledged to hold steadfast to its tradition come what may.

This is the Journal Story.

"For Editorial Excellence" among business publications, the Journal has been given this award by Industrial Marketing magazine for 6 successive years.

Journal-log OF SOUTHWESTERN OIL

MILESTONES IN AN AMAZING INDUSTRIAL GROWTH

The history of southwestern oil has been faithfully recorded in the pages of the Journal over the past 50 years. The paragraphs presented here, culled from its yellowing files, as well as from more recent bound volumes, provide the reader with a fast-moving account of some of the more momentous events that have brought the region into the forefront of international petroleum supremacy.

1901

When Spindletop was discovered only two refineries in the Southwest operating were the Corsicana, Tex., refinery of Corsicana Refining Co. (later Magnolia Petroleum Co.), and the Neodesha, Kans., refinery of Standard Oil Co. Combined output of plants, built in 1897-98 period, was about 2,000 bbl. daily.

Air lift used to produce oil wells in Spindletop, Texas, field.

On March 28, J. S. Cullinan, Dr. M. P. Cullinan, and H. L. Scales obtain charter for Texas Fuel Co. which the following year became The Texas Co.

Drs. J. W. C. Bland and Fred S. Clinton brought in a producer on June 25, near Red Fork, Okla., the depth being 534 ft. Other activity was at Gotebo, Okla., where a small refinery serviced 8-10-bbl. wells.

Andrew W. and Richard K. Mellon in May organized J. M. Guffey Petroleum Co. which acquired the assets of the Guffey interests. In November they organized Gulf Refining Co. of Texas which later was included in the present Gulf Oil Corp.

Spindletop, Texas, and Jennings, Louisiana, fields discovered—reserve, 255,000,000 bbl.

The British Shell Trading & Transport Co. contracts with J. M. Guffey Petroleum Co. to buy $4\frac{1}{2}$ million barrels of oil at 25 cents a barrel for export movement. At the time Shell was not in the oil business.

1902

J. M. Guffey Petroleum Co. (later Gulf Refining Co.) started operating a small refinery at Port Arthur, Tex., with Spindletop crude. Texas Petroleum Co. (later The Texas Co.) started building a small plant at Port Arthur connected by pipe line to Spindletop field.

First tanker leaves a Texas port . . . Tanker "Atlas" of Standard Oil Co.'s fleet loaded with Spindletop crude.

Sour Lake, Texas, and Columbia, Texas, fields discovered—reserve, 250,000,000 bbl.

May 24—Volume I, Number 1 of The Oil Investor's Journal published in Beaumont; later became The Oil and Gas Journal.

Refining plant completed on Gulf Coast by George A. Burt at Beaumont, Tex. (Plant later became property of Magnolia Petroleum Co.)

Literary Digest, outstanding national publication, says, "The horseless carriage is at present a luxury; and although the price will fall in the future, it will never come into common use as the oicycle."

Markets for Fuel oil expanding. The Southern Pacific and the Santa Fe railroads convert from coal to oil. Sugar refineries and rice plantations in Loui-

siana install oil burners. Oiled surface for highways became popular.

1903

Oklahoma's first commercial oil well went on production in August. It was the Cudahy Oil Co. 1 Nellie Johnstone, located in Bartlesville-Dewey field, Washington County.

Gun perforating used for water-well completions in Texas.

Guffey & Galey construct a 2-in. line from a gas well in Osage Nation to a brick plant north of Tulsa.

Impact of Texas crude disturbs foreign governments. France, Japan, and South Africa send military and industrial observers to report on the expanding fields. An English company begins operating in Saratoga field.

Oil begins to attract the Texas legislature as a source of tax revenue. Several bills are introduced to tap the petroleum industry.

Prairie Oil & Gas Co. lays a 32-mile 6-in. pipe line for crude oil connecting Chanute-Humboldt fields with the Standard Oil Co. refinery in Neodesha, Kans.

Foreign markets become a major outlet for new fields and refineries with Port Arthur, Tex., shipments totaling 8,989,027 bbl.

1904

Prairie Oil & Gas Co. constructs 6-in. line from Bartlesville field in Indian Territory to Caney, Kans. Special Act of Congress is required to lay the pipe through Indian Territory.

Eastern gas men enter shallow eastern Kansas gas fields, construct three 16-in. transmission lines to serve local markets.

Avant, Oklahoma, and Humble, Texas, fields discovered—reserve, 270,000,000 bbl.

Standard Oil Co. builds a 500-mile 6-in. pipe line from Kansas City to its Whiting, Ind., refinery—first outside outlet for Southwest crude oil.

Spindletop and other early fields brought scenes like this in the Gulf Coast area.

1905

Caddo, Louisiana, and Glenn pool, Indian Territory, fields discovered—reserve, 500,000,000 bbl.

Prairie Oil & Gas Co. builds pipe line from Glenn pool to its system in Kansas connecting to refinery at Neodesha, Kans.

Kansas Legislature enacts law fixing the rates for carrying oil through pipe lines. Texas imposes its first oil tax, 1 per cent on crude oil, 2 per cent on refined products, and 2 per cent on pipe-line flow.

1906

Mechanical equipment for mixing drilling mud was used in the Southwest.

Gulf Pipe Line Co. starts building a 6-in. pipe line from Glenn pool in Indian Territory to Port Arthur, Tex., refinery. Completed following year.

Oklahoma Natural Gas Co. formed to bring gas from Cleveland, Okla., to Oklahoma City; founda-

Are you old enough to remember when Dobbin and his driver got off to the side of the road when a horseless carriage approached?

tion laid for a major network of Oklahoma intrastate lines.

Eight refineries built in Kansas, three in Oklahoma, and one each in Texas and Louisiana.

Natural Gas Department, American Gas Association (originally known as Natural Gas Association of America) organized with headquarters in Kansas City.

Congress passes the Hepburn Act on June 29 providing for federal regulation of pipe lines as common carriers. Louisiana passes a law declaring pipe lines common carriers.

1907

The Texas Co. completed 8-in. pipe line from Glenn pool, Indian Territory, to Port Arthur, Tex., refinery.

Monroe gas field discovered near Sterlington in Northeast Louisiana, a forerunner of major reserve; early development attracted carbon-black producers to Southwest.

Texas gets its first important supply of natural gas from Petrolia in the north area.

1908

Southern Gas Association organized in May with present headquarters in Dallas.

Goose Creek, Texas, field discovered — reserve, 125,000,000 bbl.

The Texas Co. completes Dallas refinery. First refinery outside Gulf Coast in Texas since Spindletop.

1909

D. W. Franchot, et al., built first "casing-head" gasoline plant of Southwest at Kiefer, Okla., in Glenn pool, Oklahoma. Plant had output of few hundred gallons weekly.

Oklahoma Pipe Line Co. in Oklahoma, Prairie Oil & Gas Co. in Arkansas, and Standard Oil Co. of Louisiana in Louisiana complete pipe-line connection from Glenn pool, Oklahoma, to Baton Rouge, La., refinery of Standard Oil Co. of Louisiana.

U. S. Geological Survey recommends that surplus natural gas be stored in underground reserves; reports national consumption for 1907 was 404 billion cubic feet, and forecasts early decline in supply.

Lone Star Gas Co. lays 16-in. pipe line to bring natural gas from Petrolia, Tex., to Fort Worth and Dallas, a distance of 110 miles.

1910

Refineries began using continuous method of crude-oil distillation. Previously batch method in common use.

First large-diameter, long-distance natural-gas transmission pipe line in Texas was constructed by Lone Star Gas Co. It was a 130-mile, 16-in. line from the Petrolia field to Fort Worth and Dallas.

Vinton, Louisiana, field discovered—reserve, 110,000,000 bbl.

The Texas Co. builds its fourth refinery in Southwest, located at Tulsa.

The Oil Investor's Journal acquired by Petroleum Publishing Co. April 20. Name changed to The Oil and Gas Journal, publication office moved to Tulsa, enlarged and published weekly.

New fields of science are appearing in the oil industry, which are producing the petroleum engineer and the petroleum chemist.

1911

In February, Humble Oil Co., predecessor of the present Humble Oil & Refining Co., which became largest domestic crude producer, was chartered in Texas.

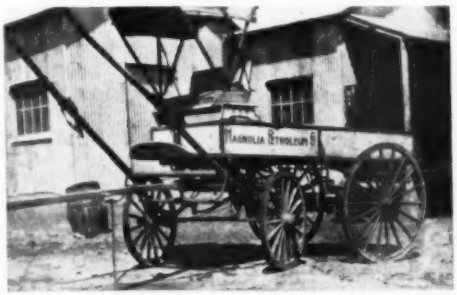
Gulf Refining Co. carried out the nation's first over-water drilling operation in Caddo Lake, Louisiana.

Seven small natural-gasoline plants operating in Glenn pool, Oklahoma, with combined output of 2,000 gal. daily.

The Texas Co. completed its 8-in. pipe line from Caddo, La., to Port Arthur, Tex.

Gulf Oil Corp. constructs a refinery at Fort Worth.

February 16—Journal begins publishing weekly record statistics on current drilling and production



This was the last of the horse-drawn delivery wagons used by Magnolia Petroleum Co. in the expansion of its marketing operations previous to 1910.

in every state, "something never before attempted by any publication."

K.M.A., Texas, field discovered—reserve, 180,000,000 bbl.

Electra pool was discovered January 17 with a 50-bbl. well.

Roxana Petroleum Co. of Oklahoma, a member of the Royal Dutch-Shell Group, was organized on October 1 to operate producing properties in Oklahoma.

Formal petroleum education was introduced in the Southwest when Missouri School of Mines offered a course in petroleum geology.

Western Petroleum Refiners Association organized in November. Present headquarters in Tulsa.

Cushing, Oklahoma; Burkburnett, Texas, and Mexia, Texas, fields discovered—reserve, 718,000,000 bbl.

The U. S. Navy announces it will gradually convert the fleet to fuel oil, widening market for Southwest's low-gravity crude oils.

Journal begins regular coverage of refining activity, noting that the industry is entering an era of many small refineries.

Journal defines "Mid-Continent" as Kansas, Oklahoma, Texas Panhandle, and Caddo district of Louisiana; definition accepted by government and industry. Later extended to include all of Southwest except Gulf Coast.

Electric power used for oil-well pumping in the Gulf Coast area.

Engineers of the newly organized petroleum division of U. S. Bureau of Mines were assigned to Cushing, Oklahoma, field to study drilling problems.

Journal carries big picture story February 13 on mechanization of agriculture, urging the industry to promote the new farm market.

Subsurface-geologic methods introduced into prospecting for oil.

Journal article in April 3 issue on "bottled gas" first calls industry's attention to the possibilities of L.P.G.

Cities Service Co. absorbed three independent Kansas gas companies.

Water flooding of old wells to build pressure becomes new oil-field technique.

Healdton, Oklahoma, field discovered — reserve, 245,000,000 bbl.

Gasoline for motor cars has become so urgent that major oil companies are turning down orders for fuel oil to reserve a refining supply. This market from motorists is starting a program of small-refinery construction.

Petroleum geology is established with arrival of E. W. McCrary in Tulsa to organize the geological staff for Guffey & Gillespie.

Crude oil bringing 88 cents per barrel in Oklahoma, with natural gasoline selling at 10 to 12 cents per gallon.

Roy M. Johnson, Ardmore, Okla., leads in development of Healdton field. Prairie Oil & Gas Co. opens gusher in Cushing field at 2,600 ft.

Journal in November 19 issue declares the science of geology is replacing guesswork in finding oil. Geologists later testified this article changed the standing of petroleum geologists.

Standard Oil Co. of Kansas started operating the first of 40 Burton cracking stills at its Neodesha,

This is how Glenn pool development in Oklahoma looked in 1914. (U.S.G.S. photo).

Kans., refinery — first cracking installation in the Southwest.

Pipe lines transmitting petroleum in interstate commerce are held common carriers by Supreme Court ruling, June 22.

Screen and preperforated pipe used in completing oil wells.

A total of 58 natural-gasoline plants are now in operation in Oklahoma, and 3 in Kansas.

First issue of the Journal (February 5) printed on its own presses in its own building.

Oil discovered near Eldorado, Kans., by Empire Oil & Gas Co.

George H. Taber, head of Gulf Refining Co., tells new Mellon Institute of Industrial Research to find out "how to make gasoline from kerosine and how to make kerosine from gasoline."

1915

Open tank car of natural gasoline caused explosion at Ardmore, Okla., killing 43 people and injuring 500. Tragedy brought tightening of regulations covering shipment of product.

Journal gives first detailed descriptions of Burton and other thermal cracking processes being tried by the industry.

Rival cracking processes are engaging the refiners who are faced with war demand for gasoline. Standard Oil Co. has five plants using the Burton method, while the Government is supporting the Rittman process which has been developed through the U. S. Bureau of Mines.

Sale of gasoline becomes the largest single source of revenue for the southwest petroleum industry.

Active wildcatting in Oklahoma develops production at Billings, Fox, Mounds, Depew, Kellyville, and other pools.

Discovery of new oil fields results in construction of 17 refineries in the Southwest.

1916

Equipment for representative compression gasoline plant handling 120,000 cu. ft. of casing-head gas daily cost $2,800. Consisted of two 15-hp. gas engines, low-stage compressor (50 psi.), and high-stage compressor (250 psi.).

Core bits are used by several operators.

The first Cross 200-bbl. cracking unit was installed at a small refinery located at Rosedale, Kans.

Oklahoma now leads in the production of casing-head gasoline, the estimated output being 200,000 gal.

Magnolia Petroleum Co. started operating one of the first large thermal cracking installations consisting of 2 batteries of 10 stills each of the Burton process.

Ohio Oil Co. entered Southwest when it purchased Mid-Kansas Oil & Gas Co. which had important production in Augusta, Kansas, field.

El Dorado, Kansas, and Barbers Hill, Texas, fields discovered—reserve, 375,000,000 bbl.

First organized meeting of petroleum geologists is held in Norman, Okla.

The declining Cushing field is revived when drilling is dropped from the Bartlesville into the Tucker sand.

Garber field leads Oklahoma surge in new development, which includes more than 30 fields, such as Bristow, Holdenville, and Newkirk.

Twenty-six refineries have been built this year in the Southwest.

Standard Oil Co. of Kansas now has 60 Burton cracking stills in operation at its Neodesha, Kans., refinery. Magnolia Petroleum Co. is operating 20 Burton stills at its Beaumont, Tex., refinery.

1917

Journal reports on production of toluene from petroleum for war needs and says this demonstrates that the chemistry of petroleum has been neglected.

Secondary-recovery operations inaugurated in the Southwest with gas repressuring in Nowata County, Oklahoma.

Natural-gasoline plants in operation in Oklahoma number 234; 11 in Texas, 20 in Louisiana, and 6 in Kansas.

American Association of Petroleum Geologists organized. Present headquarters in Tulsa.

Hope Natural Gas Co. filed patent suit against Oklahoma Natural Gas Co. involving use of absorp-

Discovery well of the El Dorado, Kansas, field.

tion method in natural-gasoline plants. Absorption method in operation at a few southwestern plants despite suit.

Phillips Petroleum Co. incorporated by Frank and L. E. Phillips at Bartlesville, Okla. The two brothers had been active as independent operators for several years previously.

Mid-Continent Oil and Gas Association organized October 13 with headquarters in Tulsa.

Fifty-six refineries, mostly skimming plants of under 3,000 bbl. daily capacity, built in Southwest.

Cement, Oklahoma, and Velma, Oklahoma, fields discovered—reserve 205,000,000 bbl.

Roxana Petroleum Corp. builds first all 10-in. pipe line from Healdton pool to its East St. Louis refinery.

Pipe lines in Texas declared common carriers and the legislature places them under jurisdiction of Railroad Commission.

Journal, in January 3 issue, predicts that some day oil will be produced in great quantities from beneath the waters of the Gulf of Mexico.

Core drill brought to Southwest for evaluation of surface structures.

First Panhandle natural gas was discovered in Potter County, Texas, in December.

One hundred and forty-five refineries operating in Oklahoma and Kansas at close of year.

Surface geology gains important recognition when L. H. Cullom brings in well under direction of Geologist W. E. Wrather, opening Breckenridge, Texas, field.

"Fowler's Folly," a 2,200-bbl. gusher, touched off the Burkburnett field boom on July 29.

Hull, Texas, field discovered — reserve, 150,000,000 bbl.

Journal editorial insists, in December 6 issue, that the new ideas of conservation, requiring agreements among competitors, must not be classed as an illegal "restraint of business."

Geologists in Texas recommend drilling offshore, where they report indications of oil structures.

Mid-Continent and Gulf refiners ordered by the War Department to produce toluene, benzene, and other products needed for explosives. First commercial output of toluene produced in April.

A diamond coring rig used at Sawyer, Okla.

Shaffer Oil & Refining Co., predecessor of Deep Rock Oil Corp., organized to take over properties of C. B. Shaffer & Associates. Shaffer was discoverer of Cushing field in 1912.

Mid-Continent Oil and Gas Association, Texas Division, organized with headquarters at Dallas.

Hugoton gas field, world's largest dry-gas reserve, discovered near Liberal, Kans.

Hewitt, Oklahoma, field discovered — reserve, 130,000,000 bbl.

West Texas gets its first refinery at El Paso, built by Rio Grande Oil Co.

U. S. Bureau of Mines establishes petroleum experimental station at Bartlesville, Okla.

David White, chief of U. S. Geological Survey, warns Southwest producers to conserve crude sup-

Wild promotion, local stock exchanges, curb brokers were part of this Wichita Falls, Tex., boom following discovery of nearby Burkburnett field. This type of stock selling ended with this period.

ply which he declares is nearing exhaustion. Predicts that within comparatively few years American motorists will be dependent on British oil.

Mid-Continent Oil and Gas Association, Kansas-Oklahoma Division, organized July 1 with headquarters in Tulsa.

Journal publishes 280-page supplement, "Oil and Gas in North America," in its May 30 issue.

First battery of Holmes-Manley cracking stills went into operation at the Port Arthur refinery of The Texas Co. on February 8.

Coring of oil wells becomes widespread in the Southwest.

Postwar collapse in crude-oil and refinery markets resulted in shutdown of a number of refineries in the Southwest, most of which had been built during war boom.

Geochemical prospecting introduced in the Gulf Coast area.

Micropaleontology utilized as a correlation aid to oil exploration.

Burbank, Oklahoma, field discovered—reserve, 330,000,000 bbl.

First acetylene welding on pipe lines performed by Noah E. Wagner, Prairie Pipe Line Co., on 15-mile, 8-in. line from Bartlesville to Ramona, Okla.

Journal editorial predicts that some day industrial power may be obtained from the energy release in splitting atoms.

Encouraging refinery production to meet gasoline demand, Standard Oil Co. (Ind.) offers southwest refiners the right to use Burton cracking process with royalty.

Natural Gasoline Association of America (originally Association of Natural Gasoline Manufacturers) organized with headquarters in Tulsa.

Dr. J. C. Karcher and Dr. W. P. Haseman conduct first successful seismic reflections in Oklahoma.

Haynesville, Louisiana; Tonkawa, Oklahoma, and Luling-Branyon, Texas, fields discovered — reserve, 373,000,000 bbl.

Prairie Pipe Line Co. welds 140-mile 8-in. pipe line from Jacksboro to Mexia, Tex.

Federal Trade Commission recognizes the Journal's drilling statistics as authoritative legal evidence.

Southwestern producers demand a tariff on oil to curtail the flood of crude from Mexico.

Operators made a unit agreement to curtail production in Burbank field, the industry's first pact to control drilling in an oil field.

Hope Natural Gas Co. loses suit against Oklahoma Natural Gas Co. involving use of absorption method in gasoline-plant operation. Decision brought rapid conversion from compression to compression-absorption method in Southwest.

Petroleum branch, American Institute of Mining and Metallurgical Engineers, organized. Present headquarters in Dallas.

Mid-Continent Oil and Gas Association, Louisiana-Arkansas Division, organized with headquarters in Shreveport.

Smackover, Arkansas, field discovered—reserve, 480,000,000 bbl.

Hugoton natural-gas field in Kansas discovered in December.

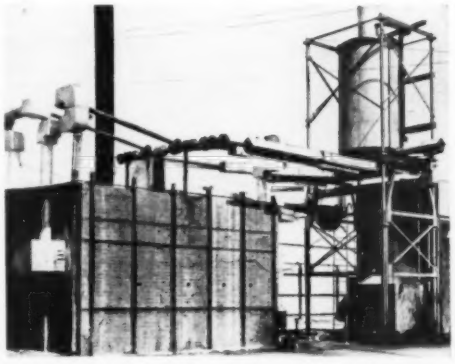
Journal editorial calls on oil industry to develop and promote practical home oil burner to open new market for surplus fuel oil.

Gravity scale of crude prices put into effect in Mid-Continent.

Reviewing the year, in its year-end issue, Journal reports it has established a complete refining and marketing department and Washington and New York bureaus; says the industry is growing stronger but needs to protect itself against outside interference.

Journal starts rotogravure pictorial section.

Moore Refining Co. installs the first U.O.P. (Dubbs) thermal cracking units at its Arkansas City,



Experimental Dubbs thermal cracking unit at Independence, Kans., in 1919.

Kans., refinery. The installation consisted of four 500-bbl. units.

The American Petroleum Institute inaugurated its standardization program for oil-field equipment through its Southwest division.

Sholem Alechem, Oklahoma; Big Lake and Powell, Texas, fields discovered—reserve, 368,000,000 bbl.

First export cargo of natural gasoline left the Gulf Coast.

LaFollette committee of Senate says oil industry is controlled by Standard Oil Co. and unless the Government regulates the industry gasoline will soon reach $1 a gallon.

Journal begins weekly series of editorials calling for united action by the industry in combating political attacks and public ignorance and in working out some method to prorate crude and keep output in line with market demand.

Magnolia Petroleum Co.'s natural-gas line is extended from Northwest Louisiana to Beaumont and Port Arthur, Tex.

The refining industry is startled when General Motors Corp. introduces tetraethyl lead, offering it on a royalty basis.

Texas grants first permit for carbon-black plant to J. W. Hassel & Associates in Stephens County.

Wewoka pool in Seminole County, Oklahoma, opened by R. H. Smith.

Activity begins in San Juan basin of New Mexico, with development of a natural-gas well near Artesia.

Western Kansas gets first development in Fairport field, 125 miles from nearest drilling.

Pure Oil Co. builds new refinery at Nederlands, Tex., around three 3,500-bbl. pipe-still distillation units for processing crude oil. Largest of their type installed up to that time. Twenty-six Cross cracking units and eight 1,000-bbl. shell stills included in plant facilities.

Journal says the LaFollette and Teapot Dome investigations have thrown oil into politics and so inflamed the public that the future of the industry is in danger.

National Oil Scouts and Landmen's Association organized with headquarters in Austin.

Magnetometer brought to the Southwest for mapping structures.

Photogeology employed in prospecting principally as an auxiliary aid to surface geology.

Gulf Oil Corp. discovers Orchard, Texas, salt dome with refraction seismograph; technique principally for reconnaissance.

"The Oil Industry's Answer," 68-page special section in the Journal, is first published description for laymen of the oil industry and how it operates. Reprinted as a popular booklet, 120,000 copies are distributed by the industry and used in defense against political attacks, becoming oil's first general campaign of public relations.

Torsion-balance method proves successful in locating shallow salt domes in Gulf Coast province.

Earlsboro, Oklahoma, field discovered — reserve, 140,000,000 bbl.

First natural-gasoline plant in West Texas was built at Big Lake.

Roxana Petroleum Corp. completes new refinery at Arkansas City, Kans., having a daily capacity of 14,500 bbl.

Barnsdall Refining Co. installs Gray vapor-phase treating unit at its Barnsdall, Okla., refinery.

Topping and cracking in one operation introduced in processing crude from Healdton field.

Recycling of natural gas is an innovation of Osage field, Oklahoma.

First units of the Jenkins cracking process in Southwest installed in El Dorado, Kans., refinery by Skelly Oil Co.

Core analysis extensively used to determine the oil content of reservoirs.

Development of most of the directional-surveying instruments under way.

McCamey, Texas, field discovered—reserve, 125,000,000 bbl.

Panhandle field of Texas becomes the world's largest gas field.

With heavy crude from flush Smackover field threatening to depress all oil prices, Journal points out that light crude is the key to the market and its output is declining. Begins segregating statistics on

Col. E. H. Humphreys and General John J. Pershing visit Mexia field in 1922. Humphreys drilled the discovery well.

First aviation refueling truck of Phillips Petroleum Co. at Wichita, Kans., in 1927.

light and heavy crudes, a practice soon adopted by Government and industry.

American Petroleum Institute devises thread standards for rotary-tool joints.

Geophysical Research Corp. surveys Edwards, Oklahoma, structure, which is the first Southwest oil field to be discovered by reflection-seismograph technique.

Aerial photographic surveys are now being employed in oil exploration.

Refineries start making petroleum alcohols in commercial quantities.

Mechanical drilling rig being introduced for use as a servicing unit.

Natural Gasoline Association of America inaugurates research work covering motor-fuel properties. Dr. G. G. Brown, University of Michigan, in charge.

Ten major fields with reserve of 2,425,000,000 bbl. discovered, the largest number of any single year in the history of the Southwest. They were: Bowlegs and Seminole City, Oklahoma, fields; and Badger, Borger-Pantex, Finley, Hendrick, Howard-Glasscock, McElroy, Pampa, and Yates and Smith, Texas, fields.

Rotary well log developed as a correlation aid.

Phillips Petroleum Co. begins commercial production of liquefied petroleum gases.

Lead in natural-gas production shifts from eastern states to the Southwest.

Automatic controls in drilling rotary wells is introduced in Mid-Continent field.

Spindletop field production again leads in Texas output.

High-strength welded line pipe makes "big inch" pipe-line projects practicable in long-distance transmission of natural gas.

Little River and St. Louis, Oklahoma, fields discovered—reserve, 325,000,000 bbl.

The first privately owned helium plant is constructed in Dexter, Kans.

First high-tensile-strength large-diameter natural-gas-transmission pipe line constructed in the Southwest for Dixie Gulf Gas Co. in Louisiana.

Big Lake field becomes first field in West Texas to be electrified. Adoption of electric power occurs with completion of large generating plant by Pecos Valley Power & Light Co.

Cities Service Co. constructs 250-mile gas pipe line from Panhandle field to Wichita.

Panhandle outlets for natural gas provide 1,400 miles of trunk lines costing approximately $50,000,000.

The Journal photographer took this picture of A.P.I. directors in the middle twenties: Walter M. Teagle, Standard Oil Co. (N. J.); H. C. Wiess, Humble Oil & Refining Co.; L. E. Phillips, Phillips Petroleum Co.; J. C. Donnell, Ohio Oil Co.; Amon Carter, independent operator and publisher; W. N. Davis, independent operator; W. S. Farish, Humble Oil & Refining Co.; E. B. Prizer, Vacuum Oil Co.; Amos L. Beaty, The Texas Co.; Frank Phillips, Phillips Petroleum Co.; W. G. Skelly, Skelly Oil Co.; K. R. Kingsbury, Standard Oil Co., of California

Some HORTON* Firsts since Spindletop that made oil a better industry

**Trademark Registered in U. S. Patent Office*

Horton Floating Roof

Economical storage of gasoline and crude oil took a big step forward when we started building this roof. As the view at the left shows, it floats directly on the liquid. There is no space for an air-vapor mixture to form under it.

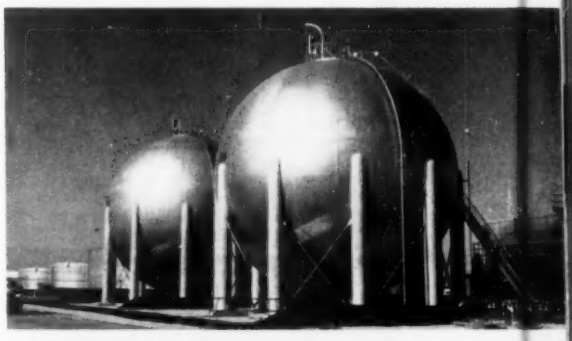
The elimination of the air-vapor mixture reduces the fire hazard and evaporation losses. It also cuts down corrosion on the inside of the tank. Thus the Horton Floating Roof means safer, more economical storage.

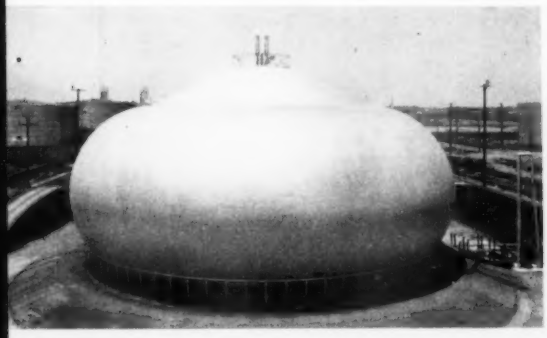
Hortonsphere

The introduction of this pressure tank made it possible to store a large volume of highly volatile hydrocarbons in one unit.

Before it was available, batteries of cylindrical tanks had to be used to store butane and butane-propane mixtures. This meant multiple fittings and connections and large ground areas.

The Hortonsphere not only stores these highly volatile hydrocarbons more efficiently . . . but also needs only *one* set of pipe connections and fittings for each installation and uses a minimum amount of ground space. It's cheaper to paint or insulate since it has less surface area per barrel of capacity.





Hortonspheroid

Prior to the development of the Hortonspheroid, the storage of natural gasoline was limited to pressure tanks of relatively small capacity. The Hortonspheroid not only solved this volume problem but it also lowered the storage cost per barrel—for it requires only one set of fittings per installation, it utilizes steel more efficiently and, like the Hortonsphere, it requires less ground space for a given volume of storage.

Literature Available

You can get more details about any tank shown on this page by writing our nearest office. We also build the Vapordome and Lifter Roofs for tanks used for standing storage of volatile liquids. Write for details on them, too.

CHICAGO BRIDGE & IRON COMPANY

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

Atlanta, 3	2184 Healey Bldg.	Detroit, 26	1514 Lafayette Bldg.	Salt Lake City, 4	525 West 17th South St.
Birmingham, 1	1536 North 50th St.	Houston, 2	2119 National Standard Bldg.	San Francisco, 4	1554—200 Bush St.
Boston, 10	1025—201 Devonshire St.	Los Angeles, 17	1523 General Petroleum Bldg.	Seattle, 1	1325 Henry Bldg.
Chicago, 4	2128 McCormick Bldg.	New York, 6	3347—165 Broadway Bldg.	Tulsa, 3	1606 Hunt Bldg.
Cleveland, 15	2204 Guildhall Bldg.	Philadelphia, 3	1615—1700 Walnut Street Bldg.	Washington 6, D. C.	1139 Cafritz Bldg.

REPRESENTATIVES AND LICENSEES

Horton Steel Works, Limited, Fort Erie, Ontario, Canada
Ateliers et Chantiers de la Seine Maritime, Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348, Caracas, Venezuela
Comprimo N.V., Amsterdam—O, Netherlands
Compagnia Tecnica Industrie Petroli, Rome, Italy
Whessoe, Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Sociedade Chibridge de Construcoes Ltda., Rio de Janeiro, Brazil

GOODALL SET THE FUTURE PATTERN FOR ALL ROTARY HOSE

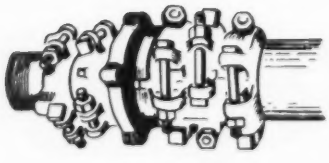
WITH THE ORIGINAL BUILT-IN BARNEY COUPLING

Everybody who was in the drilling business before 1935 will remember the troubles they used to have with leaky, bulky rotary hose couplings. Then, in 1935, Goodall Rubber Company originated the idea of the Barney Coupling . . . the first and only built-in rotary hose coupling that is stronger than the hose itself . . . the first and only rotary hose coupling which kept pace with new demands brought up by higher pressures and deeper drilling. Thus, Goodall gave the oil industry its first one-piece, leak-proof coupling . . . its first full flow coupling that was completely fool-proof. This Goodall development has proved to be the greatest single development that has ever happened in rotary hose manufacture. Goodall has continued to make improvements on the rotary hose body that match the performance of Barney Couplings. Today, Goodall Long-Life . . . with the built-in Barney Coupling . . . is the strongest, most flexible, most perfectly balanced rotary hose money can buy. ***And it is still the only rotary hose on the market in which the original built-in coupling can be reset to make damaged hose as good as new.*** Remember these facts when you buy your next rotary hose.

GOODALL RUBBER CO.
TRENTON, N. J.

GOODALL RUBBER COMPANY OF TEXAS: Houston, Texas.
GOODALL RUBBER COMPANY OF CALIFORNIA: San Francisco, Los Angeles, Seattle, Salt Lake City.
GOODALL RUBBER COMPANY: New York, Philadelphia, Pittsburgh, Chicago, Denver, St. Paul.
EXPORT: Goodall Rubber Company, Trenton, N. J.
DISTRIBUTORS: Texas and Louisiana — Houston Oil Field Material Co.; Wilson Supply Co. Oklahoma — Iverson Supply Co.

REMEMBER WHEN ROTARY HOSE COUPLINGS LOOKED LIKE THIS ?



GOODALL
HAS BEEN FIRST WITH EVERY WORTHWHILE ROTARY HOSE DEVELOPMENT!

1928

Natural Gasoline Supply Men's Association organized in May, with headquarters in Tulsa.

Eunice and Hobbs, New Mexico, fields; Oklahoma City, Oklahoma, and Agua Dulce to La Gloria, and Darst Creek, Texas, fields discovered—reserve, 2,312,000,000 bbl.

Amarillo-Denver artery for natural gas establishes new pipe-line record for Southwest, carrying 100,000,000 cu. ft. daily through 340 miles of 22-in. pipe.

Texas Pipe Line Co. introduces 60-ft. joints, electric-arc welding, factory-wrapped pipe, and airplane surveys in its Southwest construction.

Cities Service Co. extends its 20-in. Panhandle gas-transmission line from Wichita to Kansas City, Mo.

El Paso Natural Gas Co. is organized to transport gas from Lea County, New Mexico, gas fields, to the El Paso area; builds 208-mile line with delivery capacity of 36,000,000 cu. ft. per day.

West Texas becomes a distinct refining center, with 21 plants operating and 5 under construction.

Oklahoma City field discovery revises accepted geological ideas regarding Central Oklahoma.

Steel substructures for drilling derricks are introduced in the Southwest.

Texas becomes the nation's largest producer of crude oil—a position it has held since.

1929

Independent Petroleum Association of America organized in June with headquarters in Tulsa.

Vacuum, New Mexico, and Van and Ward, N.-Estes, Texas, fields discovered—reserve, 650,000,000 bbl.

Electrical logging brought to Southwest by Marcel and Conrad Schlumberger.

First underground gas-storage project in the Southwest commenced by Cities Service Gas Co. in eastern Kansas.

Unit operation undertaken in Van pool, Van Zandt County, Texas, as nation's first major unitization project.

Electric logs were run in Oklahoma wells in one of the first applications of this technique.

West Texas now has 5,500 miles of pipe line, costing $150,000,000—considered a new record for any oil area.

New Mexico gets first important oil well at Hobbs, which yields 9,720 bbl. at 4,106 ft.

Two thousand quarts of nitroglycerine are exploded in Stephens County, Texas, well.

1930

Cylindrical ram-type blowout preventers with rubber packing elements in use in drilling operations.

United Gas Corp. organized as holding company from group of small independent Gulf Coast natural-gas firms.

Biggest year in the history of the Southwest in new reserves, the ultimate, including East Texas with 5,000,000,000 bbl., being 5,737,000,000 bbl. The discoveries were: North Cowden, East Texas, and Keystone, Texas, and Rodessa (Arkansas-Louisiana-Texas) fields.

The "Wild Mary" Sudik well on March 26 made a roaring arrival in Oklahoma City field, defying control for 11 days, and attracting national attention.

First natural-gasoline plant on Gulf Coast built

Henry L. Doherty, founder and head of Cities Service Co., opens International Petroleum Exposition and Congress in Tulsa in 1930. To right of Doherty is E. B. Reeser, president, Barnsdall Oil Co., and seated immediately back of Doherty is W. G. Skelly; to Skelly's left is Secretary of the Interior Lamont.

at Raccoon Bend, Austin County, in connection with sand-repressuring project of Humble Oil & Refining Co.

Texas-to-Chicago natural-gas pipe line laid by Cities Service Co. et al. Missouri-Kansas Pipe Line Co. lets contract for 1,250-mile natural-gas trunk line from Panhandle field to Indianapolis. Ajax Pipe Line Co. starts twin 10-in. crude-oil pipe lines from Glenn pool to Wood River, Ill. Gulf Pipe Line Co. builds trunk line from Glenn pool to Dublin, Ind., reaching outlets to Ohio and Pennsylvania.

Phillips Pipe Line Co. starts 8-in. gasoline pipe line from Borger, Tex., to St. Louis. Great Lakes Pipe Line Co. starts 1,250-mile 8-in. pipe line north from Oklahoma and Kansas refineries.

Northern Natural Gas Co. is organized with capital from Lone Star Gas Co., United Light & Railways Co., and North American Light & Power Co.

As a result of depression, oil companies are becoming greatly interested in portable and unitized drilling equipment.

1931

Water-flood operations undertaken in Nowata County, Oklahoma.

Silica, Kansas; Iowa, Louisiana; and Conroe, Electra, Refugio area, and Thompson, Texas, fields discovered—reserve, 1,455,000,000 bbl.

Governor Murray orders the militia on August 4 to restrict drilling in Oklahoma City field "until oil becomes a dollar a barrel."

Governor Sterling sends troops into East Texas field to enforce proration.

First carbon-black plant in West Texas is constructed at Big Lake.

Mid-Continent refineries initiate pipe-line deliveries of gasoline to the Chicago, Des Moines, and Omaha market in July, using new facilities of Great Lakes Pipe Line Co.

Wild Mary Sudik well in Oklahoma City field attracted nation-wide attention before it was brought under control in 1931.

Stanolind Oil & Gas Co. is organized by combining operations of Dixie Oil Co. and other concerns.

Natural gas from Panhandle of Texas reaches Chicago, as Natural Gas Pipe Line Co. of America completes its 24-in. high-pressure gas-transmission line.

Northern Natural Gas Co. completes 1,200-mile 26-in. line to Minneapolis and St. Paul from Hugoton field.

Texas Railroad Commission issues order freeing natural gasoline from burdensome shipping rates.

Synthetic rubber from petroleum is advocated by refinery chemists.

1932

The first submersible drilling barge was placed in operation in September in Garden Island Bay field, Plaquemines Parish, Louisiana.

Foster, Texas, field discovered—reserve, 125,000,000 bbl.

Merger of Sinclair Oil Corp. and Prairie Oil & Gas Co. gets under way.

First well is successfully treated with acid in the Southwest, on Ackers ranch near Breckenridge, Tex. Production increased 10-fold after treatment.

Panhandle Eastern Pipe Line Co. places its major gas-transmission line in operation from Texas to Indiana.

Unitized draw works is installed on a drilling rig in Conroe field, Texas.

Improved Gyro cracking process is introduced to the Southwest, which refiners claim produces 95-octane gasoline.

Texas makes violation of its proration orders a felony, enforcing curtailment in East Texas field.

1933

Petroleum Equipment Suppliers Association organized with headquarters in Houston.

Fitts, Oklahoma, and Greta, Texas, fields discovered—reserve, 220,000,000 bbl.

The King ranch of 1,153,000 acres is leased by Humble Oil & Refining Co.

Coubrough process enabling southwest refiners to obtain larger lubricating yields.

Several refiners enter solvent market with petroleum naphthas.

Oklahoma passes new conservation law for petro-

leum industry, succeeding the law invalidated by United States Supreme Court in 1932.

New Oklahoma fields include Crescent, Keokuk Falls, Fitts-Graben.

Monument, New Mexico, and Goldsmith, Hastings, Old Ocean and Tom O'Connor, Texas, fields discovered—reserve, 1,720,000,000 bbl.

Vocational-training classes in drilling practices are sponsored by the Petroleum Division, American Petroleum Institute.

Cores becoming widely used in Southwest to plan water-flood projects of old fields.

Conroe field is definitely established as a major producing pool on the Gulf Coast.

Interstate Oil Compact Commission organized September 12 with headquarters in Oklahoma City.

Lafitte, Louisiana, and Anahuac, Texas, fields discovered—reserve, 390,000,000 bbl.

U. S. Supreme Court holds National Recovery Act unconstitutional in May.

Polyforming gains in importance. Pan American Refining Corp. awards contract for 2,000-bbl. unit at Texas City, Tex.

Slaughter-Levelland, Talco, and Wasson, Texas, fields discovered—reserve, 1,480,000,000 bbl.

Carthage gas field discovered in Panola County, Texas, forerunner of one of the nation's largest natural-gas reserves.

Glycerin, a basic commodity of trade and industry, may now be manufactured from petroleum in large quantities and at a cost below the present market, Shell Development Co. official predicts.

Gulf Oil Corp. employs furfural as selective solvent in new unit at Port Arthur, Tex., refinery; new solvent-dewaxing process, using methyl-ethyl-ketone and benzol, also begins operation at plant.

Project started to extract propane, butane, and natural gasoline in East Texas area and deliver them by pipe line to Humble Oil & Refining Co.'s Baytown, Tex., refinery.

First year in which a greater volume of cracked gasoline has been manufactured than straightrun gasoline.

Seeligson field in South Texas discovered. This is part of a general area which ranks as one of the largest oil and gas condensate reserves.

Seminole-San Angelo and Webster, Texas, fields discovered—reserve, 630,000,000 bbl.

Continental Oil Co. runs 11,975 ft. of 5-in. casing, adds another record in drilling of its 1 Herbert, wildcat test on Abbeyville Prospect in Vermilion Parish, Louisiana.

Longest and heaviest string of 7⅝-in. casing ever run is successfully cemented by Continental Oil Co. in Abbeville field, Vermilion Parish, Louisiana. String was landed on bottom at 11,342 ft. in record time of 14 hours.

Production goes deeper, with Harrison & Abercrombie completing 3 Bernard River at depth of approximately 10,300 ft. in Old Ocean field, making it first field in Gulf Coast to secure production below 10,000 ft.

Humble Oil & Refining Co. completes 1 Ellender in Louisiana at depth of approximately 11,625 ft., becoming first producing oil well below 10,000 ft. in that state.

Polymerization of refinery gases in manufacture of gasoline gaining momentum. Phillips Petroleum Co. operating 3,500 bbl. per day poly plant at Borger, Tex., using unitary thermal process.

First application of plastics to a well for the purpose of reducing the water-oil ratio was made in Rodessa field, Marion County, Texas.

First offshore well of Creole field. Superior Oil Co. and Pure Oil Co. drilled over a mile out in Gulf of Mexico at a point southeast of Cameron, La., in water approximately 13 ft. deep.

Corpus Christi Corp. in Nueces County, Texas, and Seaboard Oil Co. (Del.) at Long Lake in Cayuga field, East Texas, started operating the first cycling plants.

Magnolia, Arkansas, and Katy and West Ranch, Texas, fields discovered—reserve, 430,000,000 bbl.

Passing the record held by Gulf Oil Corp.'s 103 McElroy in Upton County, Texas, which drilled to 12,786 ft., Union Producing Co. 1 Minnine Brown in Agua Dulce field, Neuces County, has become Texas' deepest test—with total depth of 12,990 ft.

First selective polymerization plant (U.O.P.) is placed on stream by Gulf Oil Corp. at Port Arthur, Tex., refinery. Unit designed for capacity of 1,862 bbl. butane-butene fraction, separated from cracking-still gases in independent fractionating and collecting system.

Shell Oil Co. shuts down and dismantles Arkansas City, Kans., refinery built in 1924 because it did

not fit into company's marketing plans. At same time company's Deer Creek, Tex., and New Orleans refineries steadily expanded.

Commercial "mud acid" service was established in the Texas and Louisiana Gulf Coast area.

Magnolia Petroleum Co. started operating the first Houdry catalytic cracking process of fixed-bed type at Beaumont, Tex., refinery.

First instances where contractors assume risk of drilling wells under contract to 12,000 ft.

Trapp, Kansas, and Tinsley, Mississippi, fields discovered—reserve, 365,000,000 bbl. First field in Mississippi.

First use of hydraulic torque converter on drilling rigs. Purpose is to provide flexibility approaching that of the steam rig without sacrificing fuel economy.

First commercial gamma-ray well-logging service performed on a well in Polo field, Oklahoma.

American Association of Oilwell Drilling Contractors organized in November at Dallas.

Erath, Louisiana, and Hawkins, Texas, fields discovered—ultimate reserve, 625,000,000 bbl.

First hydroforming unit for catalytic reforming of heavy naphtha installed at Pan American Refining Corp.'s Texas City, Tex., plant.

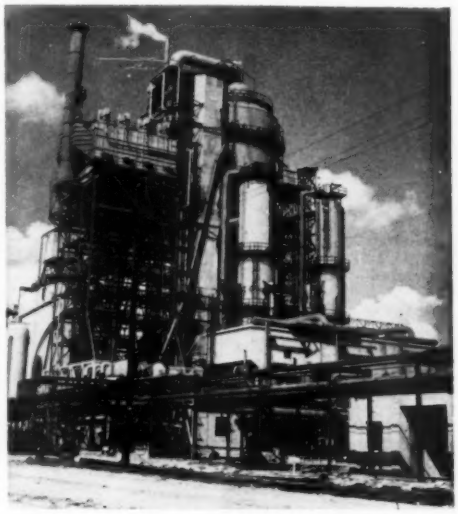
Seismograph Service Corp. develops radioactivity well-logging method, consisting of gamma-ray-surveying instrument containing gamma-ray detector, amplifier, and equipment for transmitting indications over a cable.

Petroleum may soon become major rubber source —new process by which butyl rubber is made from oil is announced.

First automatically stabilized airborne magnetometer flown in the United States.

First shipment of nitrate-grade toluene made from Baytown Ordnance Works, owned by United States Government, and built by Humble Oil & Refining Co.

Conservation at Cotton Valley field, Webster Parish, Louisiana, cited as outstanding example of unitized operation. Cycling plant uses 150,000,000 cu. ft. of gas in initial operation.



Wartime photograph of the 14,000-bbl.-daily fluid catalytic cracking unit operated by J. S. Abercrombie and Harrison Refining Corp. In 1947 WAA sold the 100-octane refinery, of which this unit was a part, to Alamo Refining Co.

Powdered catalyst used in new cracking process. Development of new continuous catalytic cracking process revealed by Standard Oil Co. (N. J.).

Pooling of aviation-fuel facilities authorized; federal direction of aviation-gasoline industry instituted by Office of Petroleum Coordinator, allocating steel for refinery construction. Current avgas production approximately 50,000 bbl. per day.

New Continental Oil Co. refinery at Lake Charles, La., sets record yield with 27 gal. of gasoline recovered from each 42-gal. barrel of stabilized crude.

Esso Standard Oil Co. (Louisiana Division) installed the first fluid catalytic cracking unit in the Southwest at its Baton Rouge refinery.

Tennessee Gas Transmission Co. granted permission to construct big-inch line from Texas to West Virginia. First major outlet from the Gulf Coast to the Atlantic seaboard states.

Fullerton, Texas, field discovered—reserve, 325,000,000 bbl.

Journal starts its "Engineering Fundamentals" series.

Journal's refinery number devoted to petroleum war products and petrochemistry in the Southwest.

Largest project of its kind undertaken to date, in volume of gas processed, is La Gloria Corp.'s pressure maintenance-hydrocarbon extraction plant in South Texas. Facilities are handling over 225,000 M.c.f. of gas daily.

SINCE 1921

LubriKup

All research and development of the LubriKup Company has been devoted to the manufacture of composition cups to meet the varying conditions of pumping oil. With the single purpose of delivering the best product that research and science can produce, we pledge to our customers and the supply stores that help us serve these customers that we will never be satisfied with making anything but the best cups possible.

LubriKup COMPANY, INC.

FIRST...
in step with a progressive, ever modernizing industry!

LUBRIKUP FIRST! ... to recognize that pumping conditions varied with depth of wells and types of fluid, necessitating soft, medium and hard cups for particular conditions and areas!

LUBRIKUP FIRST! ... to devote their entire activity exclusively to the manufacture of composition cups and cup-type packings for the oil industry!

LUBRIKUP FIRST! ... to develop the reverse bevel seating cup and seating assembly — now standard equipment with all leading pump manufacturers!

LUBRIKUP FIRST! ... to adopt composition cups to reciprocating pumps and furnish pressure seal pistons for converting them from ring or packed type to cup type — and then improved them further by making Type H Pressure Seal Pistons, the newest and most improved design!

LUBRIKUP FIRST! ... to originate the now accepted method of packaging valve cups (four matched cups to a box) to assure their factory-condition receipt in the field!

LUBRIKUP FIRST! ... to introduce the new Fluid Seal Rod Packing which gives longer packing life, less rod wear and increased pump efficiency!

LUBRIKUP FIRST! ... to offer valve cups with a 45° bottom, designed with a heavier side wall to give additional strength and longer wear, providing greater support at the heel to eliminate breakdown at the bottom of the cup!

LubriKup

- Valve Cups
- Wood-Type Valve Cups
- Seat Cups
- Seat Rings
- JerkerKups
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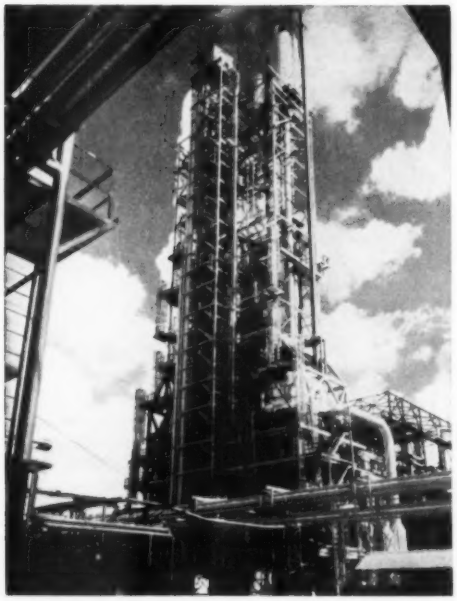

An air-lift type Thermolor catalytic cracking unit in Magnolia's refinery at Beaumont, Tex., in 1951. This modified type of T.C.C. unit replaced earlier Houdry fixed-bed crackers in Magnolia's plant.

1943

Gulf Oil Corp. started operating the first catalytic cracking units of the T.C.C. type in the Southwest at its Port Arthur refinery.

Cranfield, Mississippi, and West Edmond, Oklahoma, fields discovered—reserve, 250,000,000 bbl.

Gulf Oil Corp., Magnolia Petroleum Co., Atlantic Refining Co., and Pure Oil Co. start cooperative project to install record-size butadiene plant at Port Neches, Tex., with capacity of 110,000 long tons of G.R.S. rubber.

1944

Independent Natural Gas Association of America organized in January with original headquarters in Oklahoma City, now Washington, D. C.

Mid-Continent Oil and Gas Association, Mississippi-Alabama Division, organized October 27 with headquarters in Jackson, Miss.

Delhi-Big Creek, Louisiana; Heidelberg, Mississippi, and T.X.L., Texas, fields discovered—reserve, 525,000,000 bbl.

1945

Barker Creek dome in San Juan County, New Mexico, discovered to initiate a major gas development in the San Juan basin.

Golden Trend, Texas, field discovered—reserve, 180,000,000 bbl.

First large-scale manufacture of acetic acid, acetic anhydride, acetone, methanol, and formaldehyde from natural gas begins at Celanese Corp. of America plant near Bishop, Tex.

Shell Oil Co., Inc., places new allyl unit in operation at its Houston refinery, first in the country for production of allyl chloride and the second plant to begin commercial production of allyl alcohol, used as intermediates for manufacture of drugs, plastics, and resins.

Government's Big-Inch pipe lines converted to natural gas as an emergency measure to alleviate fuel shortage in Appalachian region. Tennessee Gas Transmission Co. commences initial delivery of 50,000,000 cu. ft. of gas daily.

1946

Texas Independent Producers and Royalty Owners Association organized March 15 with headquarters in Austin.

The "shaped charge" was used in Texas well completions to perforate pipe.

Oklahoma law requires compulsory unitization of oil and gas fields where operators holding at least 50 per cent of the field concur.

Carter Oil Co. devises the "oil pool analyzer" to predict the production history of certain types of fields 25 years or more into the future.

El Paso Natural Gas Co. constructs a 26-in. line from the Permian basin to Blythe, Calif., to serve southern California.

Lion Oil Co. leases Ozark Ordnance Works at El Dorado, Ark., for production of ammonia from natural gas. Principal product is ammonium nitrate for fertilizer. Plant later purchased by Lion.

1947

Texas Eastern Transmission Corp. acquires the Big and Little Big Inch crude oil and product pipe lines from federal Government. Converts them into natural-gas-transmission lines.

West Edmond became the first field to be unitized under Oklahoma compulsory unitization law.

World's first offshore producing well actually out of sight of land (10-12 miles out) begins produc-

tion November 17. Offshore development conducted by Kerr-McGee Oil Industries, Inc., et al.

Elk City, Oklahoma, field discovered—reserve, 120,000,000 bbl.

First ocean-going propane tank ship is constructed by Warren Maritime Corp., which converts dry-cargo vessel for transport of high-pressure propane.

"Biggest Inch" gas line is opened from Permian basin of New Mexico to Santa Fe Springs, Calif. Initial delivery of 26-30-in. line set at 175,000 M.c.f. daily.

First high-pressure centrifugal compressors for gas transmission installed by Texas Eastern Transmission Corp. at Little Rock, Ark., marking revolutionary development in natural-gas movement.

World's most automatic rig in operation by Humble Oil & Refining Co. features remote-control pipe racker and power tongs and other labor-saving devices.

Texas Gas Transmission Corp., of Owensboro, Ky., merged with Memphis Natural Gas Co. and Kentucky Natural Gas Corp., comprising a total of 1,501 miles of pipe line.

El Paso Natural Gas Co. constructed a 30-in. line parallel to its 26-in. natural-gas line to the West Coast.

Old Ocean field of Brazoria and Matagorda counties, Texas Gulf Coast, unitized on August 1. This is the largest voluntary domestic unit operation.

Scurry reef area, Texas, field discovered—reserve, 1,080,000,000 bbl.

World's first synthetic-glycerin plant starts production at Shell Chemical Corp.'s Deer Park refinery.

Jefferson Chemical Co.'s Port Neches, Tex., plant begins operation, producing ethylene glycol, ethylene oxide, and ethylene dichloride.

Jacket-type steel foundations were used for marsh operations in the drilling of a well in the Pointe-a-la-Hache field, Louisiana.

Pegasus, Texas, field discovered—reserve, 150,000,000 bbl.

Independent Refiners Association of America organized December 30 with headquarters in Houston.

Slaughter field, Texas, gasoline plant goes into operation to recover 50,000 gal. per day of propane, 92,000 gal. per day of butanes, and 100,000 gal. per day of debutanized gasoline while processing 90,000,000 cu. ft. of gas per day.

Petrochemicals industry produces nearly 5 billion pounds of crude chemicals, with Texas and Louisiana Gulf Coast plants estimated to account for 85 per cent of United States petrochemicals capacity.

Largest gas-processing plant built to date begins operation in Carthage field of Panola County, Texas. Operated by Carthage Corp., it is the largest plant built for delivery of dry natural gas for pipe-line transportation.

Southwest's deepest producer to date is completed by Humble Oil & Refining Co. in Lake Raccourci field, Lafourche Parish, Louisiana. Producing depth: 14,434-67 ft.

First experimental gas-turbine-driven gas pipeline pump is installed at Wilmar, Ark., on Mississippi River Fuel Corp.'s 22-in. line between Monroe, La., and St. Louis.

Hugoton, world's largest dry-gas field, has amazing development, with gas being found in various areas of 4,000,000-acre field. Original gas-reserve estimates vary from 22 to 29 trillion cubic feet, or 15 per cent of known United States reserve.

West Tepetate field, Louisiana, becomes first field to be dually pressure maintained and completely unitized.

First production of "cold rubber" begins at Baton Rouge plant of Copolymer Corp., using process developed by Phillips Petroleum Co. in cooperation with tire companies.

Radioactive tracers used in refining research. Catalytic reactions studied through use of radioactive hydrogen as in hydrogenation and dehydrogenation reactions.

First deliveries of gas from Rio Grande Valley to New York City through 1,832-mile, 30-in. line of Transcontinental Pipeline Co., a 225-million-dollar project.

Tide Water Associated Oil Co. started operating the first Houdriflow catalytic cracking unit in the Southwest at its Drumright, Okla., refinery.

First commercial synthesis of high-purity benzene from petroleum is now an established operation at Texas City, Tex., refinery of Pan American Refining

Stanolind Pipe Line Co. changes name in 1950.

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TO THE "JOURNAL"

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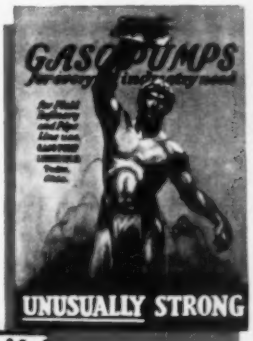

These ads, which appeared a quarter-century ago, were designed by three young artists named Matt Clark, Clifford Benton and Ed. Giesbert

All have risen to the top of their profession as creators of art that appears regularly in the big national publications and is exhibited in leading art galleries.

To the Journal we extend congratulations for a half-century of outstanding journalistic achievement.

And to the industry the Journal serves we extend congratulations as one of the most inspiring of all exponents of American initiative, ingenuity and enterprise.

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GASO PUMP & BURNER MFG. CO., TULSA, OKLA.

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SERVICES help where shortages hit hardest!

Tubing Caliper Surveys and other Wire Line Services

Sonoscope Above ground pipe inspection

Tuboscope inspection

Tuboscope Services offer a direct means of attacking and reducing the high costs of drilling and producing: ▶ **Protecting your drill pipe** and casing with TUBE-TECTORS, the **laminated** drill pipe-casing rubber protectors with the most effective gripping strength; ▶ Inspecting your drill pipe, tubing, and casing with Tuboscope and Sonoscope, the only scientifically accurate methods of non-destructive testing in the field. Frequent inspection assures the maximum safe life from each length of pipe, prevents discarding pipe still useable. ▶ Tubing Caliper Surveys, on wells under pressure, locate, measure, and record irregularities on the inside surface of tubing, show exactly which lengths are good, which should be discarded. Tuboscope helps where shortages hit hardest. Write or call for more information on reducing your costs and saving hard-to-get pipe.

Tube-Tectors installed directly from Applicator to pipe on rig floor.

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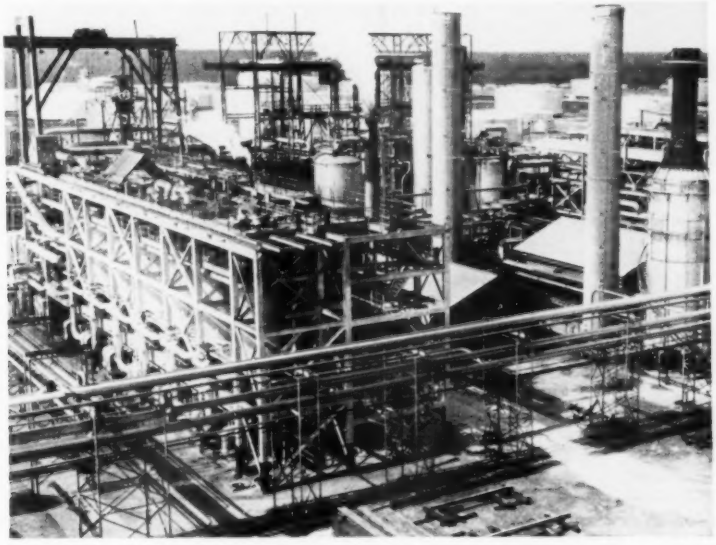


First Houdry fixed-bed catalytic cracking unit installed at the Beaumont, Tex., refinery of Magnolia Petroleum Co.

Corp. Operation of benzene-production facilities incorporates hydroforming unit.

Underground storage of L.P.G. in salt reservoirs initiated.

Construction work started on the first Platforming unit in the Southwest at the Fort Worth refinery of Premier Oil & Refining Co.

Equipment was installed on leases in East Texas field to automatically flow wells and switch stock-tank flow.

First steam-turbine-driven centrifugal-compressor equipment ever to be installed on a natural-gas pipe line announced by Transcontinental Gas Pipe Line Corp. for its 1,800-mile line from Texas to New York City.

North Cowden, Texas, field one of largest cooperative gas-injection projects, is placed in operation, with 32 operators joining in program.

United States Supreme Court upholds Oklahoma Corporation Commission's authority to set minimum natural-gas price.

El Paso Natural Gas Co. wins 2-year fight for authority to build gas line from San Juan basin of New Mexico to Topock, Ariz.

Oklahoma Supreme Court upholds constitutionality of state's unitization law.

New England area assured of natural-gas supply from Southwest, when Federal Power Commission approves two big pipe-line-construction projects.

All Sinclair crude and products pipe lines put under one firm, Sinclair Pipe Line Co., making it world's largest carrier system.

El Paso Natural Gas Co. will install internal-combustion turbines for driving centrifugal compressors on its gas system.

Transcontinental Gas Pipe Line Corp.'s Texas-to-New York 30-in. natural-gas line officially opened.

Korean crisis brings allocations and restrictions in equipment and supplies.

Gulf Oil Corp.'s orders Southwest's largest catalytic cracking unit for its Port Arthur refinery—capacity: 60,000 bbl. per day.

United States Supreme Court follows California case, rules Government has paramount rights to tidelands areas off both Louisiana and Texas coasts.

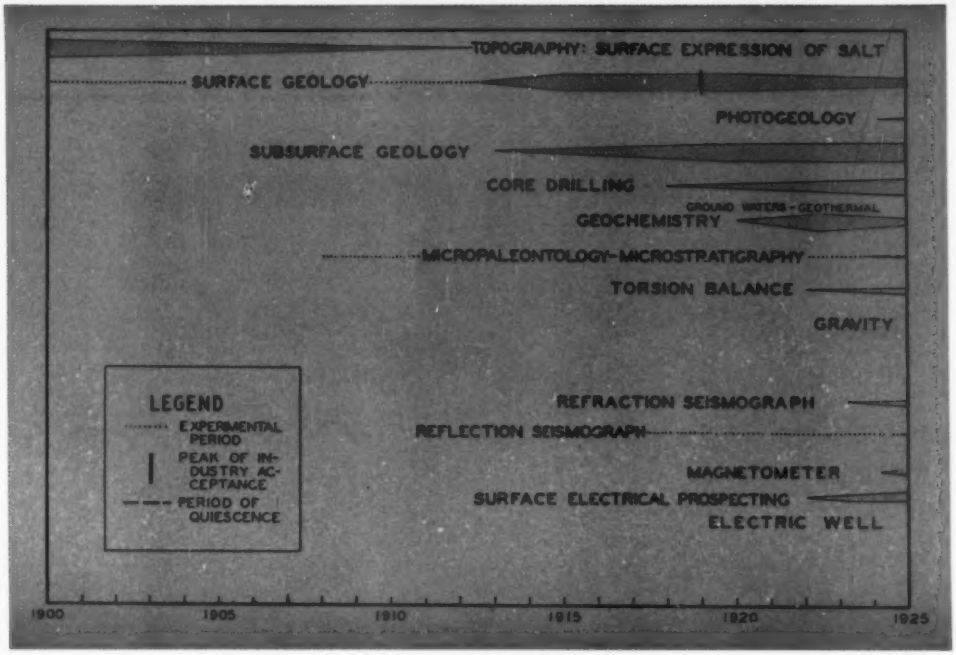
Humble Oil & Refining Co. completes extensive refining-research center at Baytown, Tex., plant.

Sun Oil Co. unveils its new high-speed electronic reservoir analyzer at Beaumont, Tex., which predicts future behavior of oil fields.

Federal freeze on Gulf Tidelands activity means it will take 22 years to pay out investment in oil development.

New 700-mile natural-gas pipe line from Monroe, La., to Michigan City, Ind., planned by Gulf-Michigan Gas Transmission Corp.

Work in progress on 1,330 miles of 26-30-in. pipe line for Texas-Illinois Natural Gas Co. from lower Gulf Coast to Chicago.



The above chart correlates the various prospecting methods employed by the American petroleum

A Half Century of Exploration

by Joseph A. Kornfeld

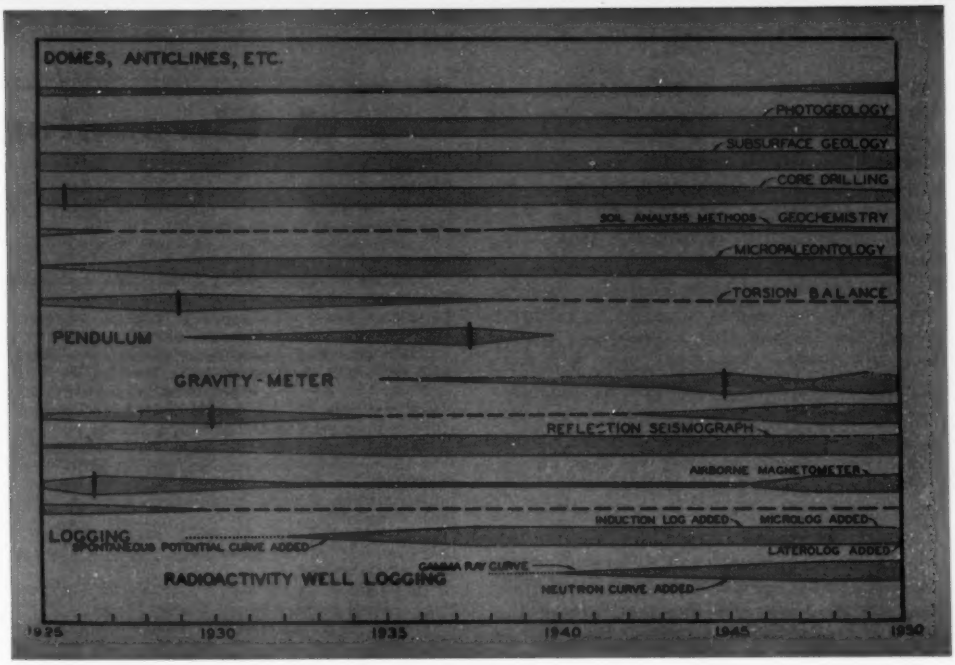
SPINDLETOP'S discovery in 1901, the result of the application of a few, simple, known direct approaches to structure finding, marked but the threshold to the art of prospecting. At the turn of the century, prospecting was largely the individual "know how of the lone wildcatter." The pattern employed on the Gulf Coast and in the Southwest for several years afterwards generally varied little from that employed by Lucas in prospecting near Beaumont—mound prominences and gas seepages to point the way.

The basic pattern of surface mapping, the first major exploration method, held predominance during the World War I period, but waned as subsurface geology blossomed into a science by 1920.

But a series of significant mutations was to appear after World War I. These took the form of strikingly new methods garnered from many sciences—geochemistry, micropaleontology, microstratigraphy, and the formal geophysical techniques—gravity, seismic, magnetic, and electrical.

It was the ingenuity and the perspective of the American oil prospector combined with the willingness to draw on the entire field of chemistry-physics that provides the assemblage of methods knit into the prospecting fabric.

In the course of the development of this art, certain methods were to enjoy a brilliant, but short-lived, single cycle of success. The refraction seismograph, for example, held high popularity for slightly less than a decade, only to be rapidly supplanted by the reflection seismograph, much as we know it today. In one field of applied geophysics, that of gravity, three methods were successively to attain prominence in prospecting. The torsion balance waxed prominent for more than a decade but was supplanted by the gravity pendulum which was widely used for 5 years. In turn the gravity pendulum was superseded by the gravity meter which remains one of the major exploration tools to this day. Other methods, like the magnetic, were to undergo more than one cycle of acceptance, the first after 1924, the second since World War II.



industry and visualizes the inception, growth, and popularity of each method from 1900 to 1950.

in the Southwest

Industry drew on many sciences in its quest of improved methods of locating oil. Here is the saga of these efforts . . .

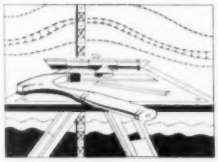
The depression of the 1930's greatly influenced the acceptance of new methods by the oil industry. Severely curtailed exploration budgets not only required justification for trying new methods but placed a premium on low-cost methods which would yield high resolving power to find structures. However, new methods, such as electrical logging, at first accepted experimentally by the industry, rose rapidly in popularity as advancements kept pace with application.

WHY did Anthony F. Lucas, discoverer of Spindletop oil field, drill at the particular spot that was to yield the first oil of gusher quantities in the Southwest? What methods did he employ in the exploration for oil near Beaumont at the turn of the century that were to transform a youthful oil industry into a major enterprise? These are the representative questions often asked by those who want to

TOOLS THEN AND NOW—AN EVOLUTIONARY STUDY

1901—The Direct Approach Predominated

- simple trend theories
- the anticlinal theory
- mound prominences
- oil and gas seepages
- outcrops



1951—Indirect Approach Predominates

- exploration thinking combines structural with stratigraphic traps
- the seismograph
- the gravity meter
- airborne magnetometer
- electrical logging
- photogeology
- micropaleontology
- microstratigraphy
- core methods

know the exploration techniques involved in the discovery of Spindletop and the other Gulf Coast fields that were to follow within a few years.

Back in 1897, Lucas, a mining engineer, discovered rock salt at Grand Cote, La. Two years later, he found both oil and salt at Anse La Butte field near Lafayette.

It did not pay to drill for oil at Anse La Butte and Lucas sought newer areas to prospect. Word came to him that a prominent mound near the town of Beaumont, Tex., had been drilled without success by three oil companies to depths below 250 ft.

His curiosity was aroused and he made a trip to Big Hill, as the dome was then known. The engineer studied this elevation which rose 12 ft. above the Coastal Plain. The circular shape of the mound commanded his interest. He also observed seepages of sulfureted hydrogen gases at the apex of the hill. Structure and seepages gave him the idea that here at Big Hill were conditions analogous to those he had observed at Belle Isle, La.

Proximity to visible seepages of oil and gas had been employed by the early Appalachian prospectors in the four decades of exploration that antedated Spindletop. The Drake well was drilled near well-known oil springs. Later oil fields were found near prominent seepages in oil provinces in many parts of the growing American empire.

Direct indications were followed wherever they were observed. Gas seepages in the swamps of Louisiana; asphalt pools south of

A Chronology

1901—Spindletop prospected as a salt dome.

1908—Dr. J. A. Udden studies cuttings from wells drilled for oil in Illinois; prepares background for new science of microstratigraphy.

1913—Surface geology enters the field of exploration.

1913—Subsurface geologic methods introduced into prospecting.

1918—Core drill brought to Mid-Continent for evaluation of surface structures.

1919—Dr. J. C. Karcher conducts experiments with reflection seismograph near Washington, D. C.

1920—Geochemical prospecting brought to Gulf Coast province; H. E. Minor of Gulf maps geochemical anomaly on Tomball prospect.

1920—Micropaleontology introduced as a correlation aid to oil exploration; universities plan formal courses in the new science; oil companies soon set up laboratories to study foraminifera, diatoms, radiolaria, conodonts.

1921—Karcher and Dr. W. P. Haseman conduct first successful seismic reflections in Arbuckle Mountains of Oklahoma.

1922—Royal Dutch Shell and E. E. DeGolyer bring torsion balance to the United States.

1922—Core drill scored first major success in Mid-Continent; major extension to Tonkawa oil field developed by this exploration tool; major companies rapidly adopt the method.

1922—First torsion balance instruments received in the United States.

1923—Refraction seismograph brought into Oklahoma and North Texas.

1924—Torsion balance method used for reconnaissance system for finding maxima anomalies; Nash, Long Point, Clemens, Allen salt domes found on the Texas Gulf Coast.

1924—Gulf discovers Orchard salt dome with refraction seismograph; technique principally fan reconnaissance.

1924—Photogeology, as an auxiliary tool to surface geology, enters the field of prospecting tools.

Standing beside a buckboard wagon with the surrey on top is R. J. Riggs, taken while working for Producers Oil Co. (The Texas Co.) on a surface detail job in northeastern Oklahoma during 1915.

One of the first torsion-balance crews to operate in Oklahoma was Carter Oil Co.'s Party 1 shown above at Tonkawa in the fall of 1926. The men are Joe Savage, observer; H. Beck, computer; and J. T. Marsh, observer.

# of Prospecting

1924—Magnetometer brought to the United States for mapping petroleum structures.

1925—Karcher improves refraction seismograph; invents radio time break, sound surveying, and electrical recording for seismic work.

1926—Rotary well log developed.

1926—G.R.C. surveys Edwards, Oklahoma, structure; first Mid-Continent oil field to be discovered by reflection seismograph technique.

1927—Refraction seismograph campaign by five major oil companies outlined 10 salt domes in East Texas basin in only 10 months.

1929—Electrical logging brought to the United States by Marceland Conrad Schlumberger.

1930—Deep domes era in seismic surveying; surveyed distance replaces air-wave distance.

1930—Refraction seismograph exploration subsides; supplanted by gravity pendulum and reflection seismograph.

1932—Electrical logging of core holes provides new exploration tool.

1932—Gravity pendulum brought to Texas Gulf Coast.

1936—Levorsen presents stratigraphic trap concept to the oil industry; warns against overspecialization in structural prospecting.

1936—John C. Bender patents invention covering many phases of radioactivity well logging.

1940—First commercial gamma-ray well-logging service performed on a well in Polo field, Oklahoma.

1941—First commercial neutron logging service initiated.

1941—First automatically stabilized airborne magnetometer flown in the United States.

1946—Airborne magnetometer introduced into geophysical prospecting; magnetic surveying for oil structures reborn.

1950—Quantitative analysis of porosity from neutron log developed.

the Arbuckles in Oklahoma; "paraffin dirt" on the many surface prominences of the Gulf Coastal Plain as Humble, Damon Mound, Barbers Hill, and Hockley, as well as sharply upturned layers of sandstone saturated with oil in the Wichitas of the Sooner State. All these were marked with an "X" on the prospector's map. Drill here! it cried out to the explorer.

Out of a maelstrom of methods, some scientific, others doodlebug, were to survive a few techniques that were later found to be backed by a semblance of scientific reason—the topographic method, and trends.

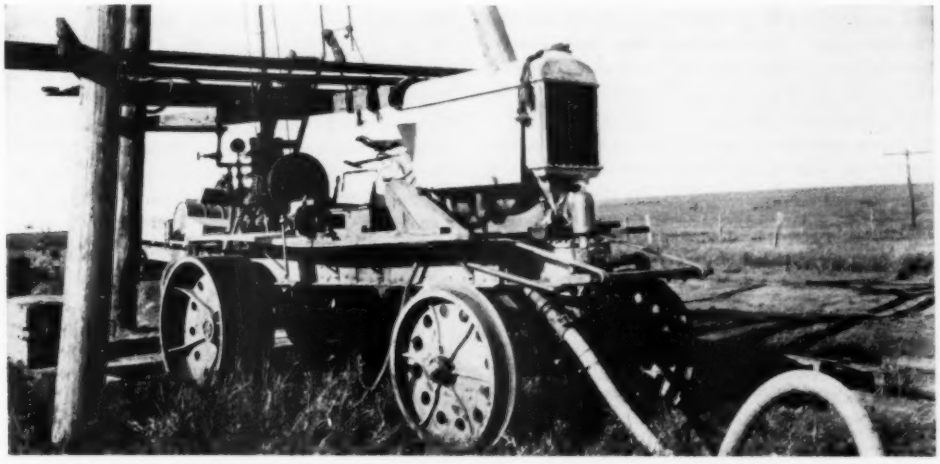
The history of prospecting for oil and gas may be divided into two broad, major groups: Structural and Stratigraphic.

Structural Prospecting

Geological Methods

Surface geology period.—After Spindletop, drillers and operators long pondered the devious ways in which Nature had entrapped oil and gas in the recesses of the earth. The post-Spindletop techniques of exploration were both structural and seepages, the same criteria of exploration that had led Lucas to Big Hill. Thus in the ensuing 5 years from 1901, nearly every principal surface mound, prominence or elevation along the Gulf Coast, received testing in search of oil accumulations.

Oil men early found that it was the flanks of the dome that carried the major accumulations of oil and gas. To illustrate, the redis-



An early-day wagon-mounted core-drill unit used in exploration work in Osage County, Oklahoma, during 1930.

E. L. DeGolyer, Dallas, was "the well dressed young geologist" as he prepared to go to Mexico soon after graduation from college.

Surface surveying party using alidade and plane table in Osage County, Oklahoma, about 1915. The rodman at right rode horseback to various outcrops.

Wilcox Oil & Gas Co. 1 Gracie Call discovered the "second break" in the "Mississippi" lime south of Tulsa in 1913, to open up the famous "Wilcox" pay. This initiated the subsurface geologic search for oil pools in rocks of Ordovician age.

covery of Spindletop which occurred in 1924 when Miles Yount found flank oil, was to yield more oil since that date than in all of the years prior.

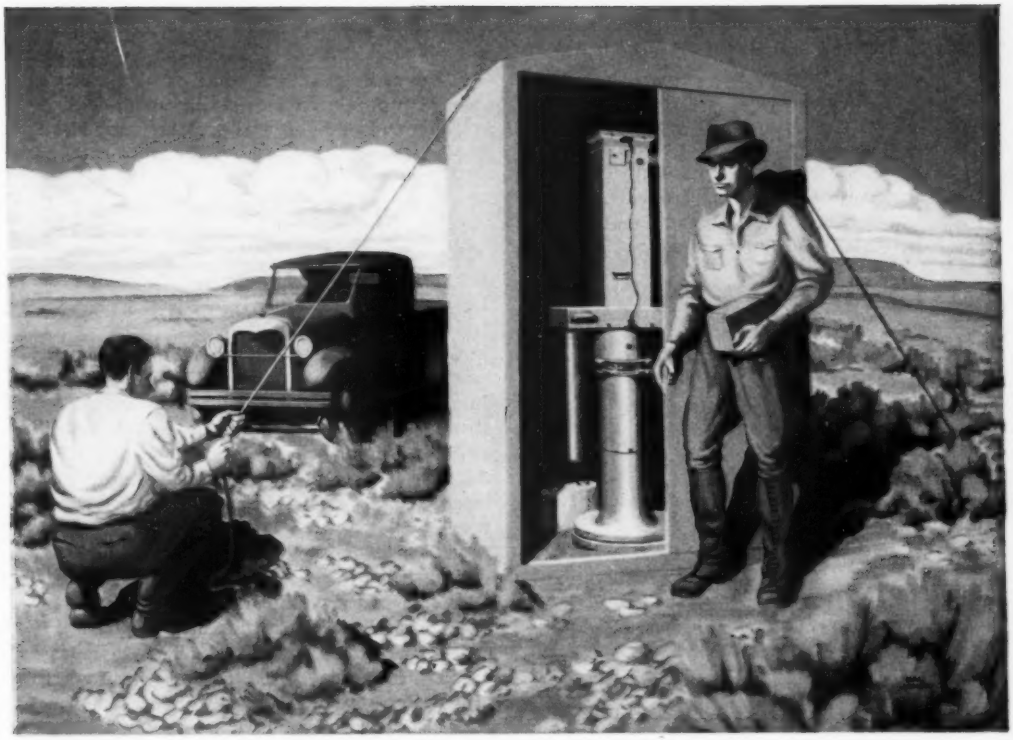
Once the dome was found, explorers employed a simple technique of finding the buried edge of the salt or cap-rock core. Thus, at Moss Bluff near Liberty, Tex., one major company drilled a series of exploratory wells from the salt core radially outward in search of the "golden rim." This method was very costly, but helped to find the "halo" that delineated the pinchout of the rich unconsolidated sands. These beds were wedged out against the flanks of these spindles of salt that rose out of the depth of the Gulf Embayment from the "mother bed" 4 to 5 miles below the surface.

At the outset of the twentieth century, geology as a science was the province of cloistered college classrooms and erudite professors. In the Southwest, valuable reports were issued by the Oklahoma Geological Survey by early-day geologists such as Gould, Hutchinson, and others. Likewise the Kansas Geological Survey did valuable work that laid the frame for later surface-geological exploration.

Formal field investigations prepared by both state and federal geologists gave impetus to advancement of the acceptance of geology as a guide to the study of oil and gas accumulations. Case histories of oil fields of the Gulf Coastal Plain were prepared by Hayes, Kennedy, Fenneman, and Harris of the United States Geological Survey.

Formally trained geologists, schooled in the orthodox methods of stratigraphy and paleontology, began to assert their influence on the Mid-Continent prospecting horizon. In 1904, H. B. Goodrich located Wheeler oil field in southern Oklahoma from surface geology. A. C. Veatch worked for Houston Oil Co. in the Gulf Coast region during 1901-02. The Haworth team, father and son, won recognition at University of Kansas for their surface-geology studies of the Permian and Pennsylvanian lime scarps of eastern Kansas. Early-day pioneers in surface geology in the Mid-Continent included James F. Gardner, W. E. Wrather, and Gould.

The year 1913 is mentioned by DeGolyer as the date of the actual acceptance by the oil industry of geology as a guide to prospecting. That year saw the introduction of geological departments in the Mid-Continent, particularly at Tulsa. The surface geologist came into his own.



CHAPTER SIX in the fascinating Story of the Search for Oil

In 1928 The first of the geophysical methods to be used in oil prospecting was that of surveys of variations in the earth's gravitational field by the use of the Eotvos torsion balance. The torsion balance was essentially a modification into a comparatively robust field instrument of the older and more fragile Coulomb balance which had been used in physical laboratories since the 18th century for investigating and demonstrating the laws of gravitational attraction. About 1920, E. DeGolyer, then head of the Amerada-Rycade Oil Companies, became interested in the instrument. In 1922, Donald C. Barton proceeded to Budapest at DeGolyer's instance and acquired two of the balances. The first torsion balance surveys in the United States were made in the Spindletop, Texas salt dome field in early December, 1922, but the first geophysical prospect to be proved in the United States was on the Nash Ranch in Fort Bend County, Texas, where oil was discovered on the flank of a salt dome on January 3, 1926. The use of torsion balance for oil prospecting reached its peak in 1928-29. From E. DeGolyer's book, "*The Development of the Art of Prospecting*," and from a report by Dr. J. Brian Eby.

In 1951 With the commemoration this year of the 50th Anniversary of the discovery of the Spindletop field, the oil industry has moved into a new era which will demand more petroleum products than any other period in the history of the world. In order to help locate these reserves for the future, General Geophysical now has more crews in the field than at any other period in the history of the company. Working with specialized seismograph equipment . . . developed in General laboratories to meet specific needs for various areas . . . these General Geophysical crews are scattered from Canada to the Gulf Coast. And from the data compiled by these capable crews, geologists and geological departments within the next few years will make the key decision to drill hundreds of wells. For more than 15 years, operators have relied on General's experienced crews to determine and locate conditions favorable to finding new oil reserves. So when you plan to explore new areas and deeper horizons for tomorrow's reserves, let General help you. The percentage for success is in your favor.

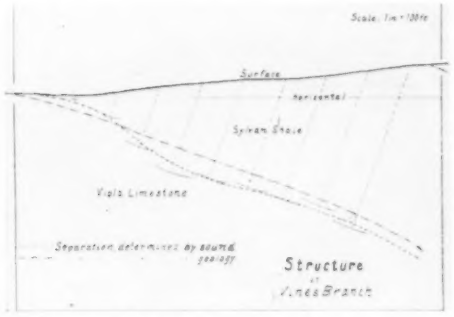
General

GEOPHYSICAL COMPANY

GULF BLDG. HOUSTON

A PRINT OF THIS ILLUSTRATION SUITABLE FOR FRAMING WILL BE SENT ON REQUEST

The Empire Gas & Fuel Co. geological department at Bartlesville, Okla., headed by Everette Carpenter, employed a large number of surface-geology parties throughout the following decade. Graduates of the geology departments at Universities of Oklahoma, Kansas, Texas, and other schools, fresh out of surveying classes, were organized into surface crews. Outcrops of the Paleozoic of the northern Mid-Continent province were carefully mapped. Alidade and plane-table groups swarmed through the scrub oak-covered sandstones of eastern Oklahoma and the barren limestone rim hills of eastern Kansas in search of closure or a prominent terrace. Geological thinking was still grooved to the magic of the closed contour as possible drill sites for wildcat exploration.



The cross-section here above illustrates the close agreement between the depths to the Viola limestone as determined by sound and by geology proving the validity of pioneer seismograph exploration at Vines branch in the Arbuckle Mountains, Oklahoma, in the fall of 1921.

ARBUCKLE MOUNTAINS LOCALE OF PIONEER SEISMIC EXPERIMENTS

DRS. J. CLARENCE KARCHER and W. P. Haseman, pioneer geophysicists, conducted their first field experiments to obtain seismic reflections back in the early fall of 1921 near Davis, Okla., in the Arbuckle Mountains.

"The first successful efforts to obtain seismic reflections," writes Dr. Karcher, "were made in August, September, and October 1921. Records were obtained first on Vine's Branch dome in the Arbuckle Mountains in Oklahoma and about a month later on the east slope of the Deer Creek anticline in northern Oklahoma."

Describing the series of observations he states that "the shots and instruments were placed about 300 ft. apart. After recording one or more shots from a given shot hole, a new shot hole was dug 100 or 200 ft. distant.

"Then the seismometer was moved the same distance in the same direction," he noted, "so that a series of observations along a line with constant intervals between successive shot and seismometer positions were thus obtained."

Thus the Arbuckles, locale of many Mid-Continent geologist's early training, proved the sounding board against which a new geophysical instrument was to be tried. This marked a major step forward in man's attempt to probe the secrets of the earth to the end that more oil would be found to enrich the world.

Core drilling, at first a tool for the surface geologist, developed into stratigraphic drilling in later years as a tool of the subsurface geologist.

Historians are in agreement as to the pioneer of the introduction of the diamond core drill into the Mid-Continent area for use in the determination of structural conditions. They grant this credit to Marion M. Travis, now of Los Angeles, and formerly head of Midco Petroleum Co. in Tulsa. While visiting some mines in Colorado during the summer of 1918, Travis saw a steam-driven core drill in operation. Impressed with its possibilities as an aid to structure-finding in the area, he contacted with E. J. Longyear Co. of Minneapolis, who designed a gasoline-driven diamond core drill, mounted on a steel frame and equipped with wheels.

This machine was used early in 1919 to verify structural conditions on two supposed folds mapped by the Government on the Chilocco Indian Reservation in Kay County, Oklahoma. Travis states that about 25 holes, ranging from 50 to 200 ft. in depth, were drilled. The core drill served to indicate that a mistake had been made in surface mapping.

Marland Refining Co. (now Continental Oil Co.) in October 1921 purchased its first diamond core drill. It was a Sullivan "H" machine for cutting a 1-in. core and the drill was first used in Section 27-25n-3w, Grant County, Oklahoma.

The major role of core drilling in mapping structure came during 1922 following the discovery of Tonkawa field in Kay and Noble counties, Oklahoma. The surface cover precluded mapping by usual surface-geogoly methods. The core drill furnished the right tool to penetrate the cover and reveal the true attitude of the shallow beds.

Marland and Roxana Petroleum Corp. jointly core drilled the area. Subsurface-structure contour maps obtained from core-drill data indicated that the structure did not align itself along the usual north northeast to south southwest trends which marked the principal axes in this area. On the contrary, a major cross fault intersected the structure and the principal part of the structure was found to lie to the northwest.

The success attendant to development work at Tonkawa, based on accurate core-drill work,

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encouraged these companies to extend exploration to other areas where favorable structural conditions were believed to be present.

At the time, the Marland and Roxana firms were the only companies using the core drill. In March 1923 Gypsy Oil Co. (now Gulf Oil Corp.) adopted the tool. By 1925, several other companies began to use it. A survey made in the spring of 1926 showed that 9 or more companies were using 35 drills in Kansas and Oklahoma.

When first introduced to the industry, the core drill was a relatively clumsy affair. The core drill used by Travis drilled two or three 125-ft. holes a week. Tractors were used in transporting the equipment from one location to another. The mast consisted of the ancient tripod of long poles.

The first drills used were steam-driven equipment cutting a 1-in. bore. Due to the soft nature of the Permian and Pennsylvanian rocks penetrated, it was difficult to get good core recovery with a bit of this small diameter. Equipment was redesigned to permit recovery of a 2-in. core. Steam-driven drills were common practice until the spring of 1924 when Marland Refining Co. began experimenting with a Fordson-driven drill. By 1925, manufacturers were offering drills equipped with Fordson motor drive and mounted on steel frames and wheels.

When the core drill was first used, cores were taken from the surface down and only diamond-studded bits were run. Where the key beds lay at considerable depth, the common practice was to "fishtail" the upper beds and use the diamond bit only on the particular beds where the correlations were to be based.

In the fall of 1925, introduction of a hard-surfacing material for coating the steel bits in use resulted in tripling the footage of fishtail bits. A new alloy called stellite, of cobalt-tungsten-chromium composition, was applied to the wearing surfaces of the fishtail bit by means of an acetylene blowtorch. The effect of this improvement was to materially lower the drilling cost per foot and enable companies to widen their exploratory programs.

George E. Failing, of Enid, Okla., is recognized as one of the pioneers in development of the modern core drill. He brought it up to its present high efficiency. It was Failing who mounted the first light drill on a truck and drove it with the truck motor. This drill could back up in a fence corner, drill a 50-ft. hole, and be moved to another setup a mile away in only an hour.

Frank Buttram, president of Buttram Petroleum Co., shown at the discovery well of the South Corsicana, Texas, field, which he brought in on August 16, 1923.

Then followed a series of heavier models, mounted on trucks, which obtained power from the truck engine. However, the truck-mounted drill outgrew the field of geological exploration and found wide application in slim-hole drilling in oil production.

By 1936, heavy-duty core-drill units were mounted on 4 and 5-ton trucks. These were equipped with heavy-duty drums, kelly feeds, and improved mud pumps.

After 1930, a new phase of geological exploration utilized the electric log. The log, surveyed after the drilling of the fishtail hole, obviated the need for taking cores except for paleontological control. This method accelerated this type of exploration.

Subsurface geology period.—About 1913, exploration entered the subsurface phase. A major impetus to the application of subsurface geological work in Mid-Continent oil prospecting came with the discovery of a significant oil pool in an older geologic system—the *Ordovician*. Homer F. Wilcox, a Tulsa wildcatter, struck oil near the town of Bixby in a formation then called the second break in the "Mississippi" lime by Tulsa County drillers. However, the discovery did not uncover the first oil to be found in the Ordovician in Oklahoma. Stuart K. Clark says that dates on driller's logs indicate that as early as 1912 oil

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Discovery well of El Dorado field, Butler County, Kansas, discovered by Empire Gas & Fuel Co. 1 Stapleton in May 1917.

The Humphreys Corp. 1 Meador, completed during 1920, opened up the famous Mexia field in Limestone County, Texas.

was found in beds of Ordovician age in the north end of the Glenn pool. It was on a closure below the stratigraphic trap that marked the younger Pennsylvanian strata.

The Wilcox strike near Bixby attracted a lot of attention to the possibilities of finding oil in deeper strata throughout a wide belt in eastern Oklahoma including Tulsa, Okmulgee, Creek, Okfuskee, Muskogee, and other counties.

In honor of the discoverer, the formation was named the "Wilcox" pay (not to be confused with the Wilcox of the Eocene series of the Tertiary system of the Gulf Coast). Geologists observed that the Wilcox pay was productive on quaquaversal (dipping in four directions) domes. The fact that these Wilcox reservoirs were usually reflected in the surface rocks also proved a stimulus to the work of the surface-geology parties.

Geologists prepared graphic logs on standard scales of the sequence of formations recorded by the driller. By referring these "plotted-log strips" to a sea-level reference plane, it was possible accurately to map the subsurface expression of the anticlines of eastern Oklahoma and Kansas. Dry holes were often clues to the edge of another structure and well-log records were prized. Oil companies, however, exchanged records with each other. With the formation of state well-log bureaus, voluntary exchange was stimulated.

Cooperative study groups were formed by oil companies for the preparation of geologic cross-sections across counties to clarify driller's records. Later, this was augmented by state and federal geological surveys. Local geological societies conducted field trips to tie in the driller's formation names with the recognized scientific nomenclature of the outcrop. Although surface mapping in the Mid-Continent reached its zenith during the ensuing decade, subsurface mapping became firmly entrenched in the field of prospecting. Soon it superseded the alidade and plane-table method of locating possible drill sites.

The next major advance in subsurface geology came in the form of a series of correlation aids. Heretofore, the log of the cable-tool well was prepared by the driller. The driller's log in certain areas, such as Kay and Noble counties, was carefully prepared by competent drillers. S. K. Clark states that core drilling done by Marland sometimes showed good agreement with drillers' logs from nearby wells. In other areas, geologists were reluctant to place much emphasis on the quality of the driller's log and direct collection of samples was made on the derrick floor by these technologists.

Introduction of the rotary method of drilling in Oklahoma near Quay in 1924 brought a new problem in well logging. However, a series of experiments made by the geological departments of Marland Oil Co. of Oklahoma and Gypsy Oil Co. about 1926 showed that a satisfactory log could be made from a continuous set of rotary cuttings.

A settling device was invented by installing a weir in the wooden flume carrying the rotary drill cuttings direct to the settling pit. Especial care was necessary in the washing of rotary

One of the big oil fields of the Mid-Continent was Burbank, discovered by Marland Oil Co. (Continental Oil Co.) in May 1920.

cuttings since each individual fragment of sand, shale, or limestone, as it comes from the well is coated with a thin film of rotary mud.

Another problem which confronted the exploration geologist with emphasis at this time was the obtaining of accurate depth measurements. Two possible sources of error in determining the depth which is represented by the sample were (1) those due to inaccuracies in determination of the depth at which the drill was working, and (2) those due to the lag in the return of the cuttings.

The next important development in correlation aids was the introduction of the science of microstratigraphy to oil and gas prospecting. One of the pioneer students of microstratigraphy was J. A. Udden. As early as 1908, Udden made microscopic examinations of cuttings obtained from wells drilled for oil or water in Illinois. He was the first to give a detailed outline of procedure in well-cutting examination. Prof. F. B. Plummer credited Dr. Udden with the introduction of micropaleontology into Texas from Illinois.

Carey Croneis states that applied micropaleontology did not develop in the Texas Gulf Coast until 1920 when Alva C. Ellisor, Hedwig T. Kniker, and Miss Esther Richards, now Mrs. Paul L. Applin, began their studies of foraminifera.

During the drilling of an exploratory well, the paleontologist provides valuable guidance. Identification of formations through fossil study of rock samples from a well helps to determine various factors: the position of the formation in relation to the oil zone being sought, the probable depth of the objective, and whether it lies below the point reached by the drill, or whether it has been passed.

Micropaleontology materially aided in the evaluation of unconformities, facies changes, structural conditions, and in the correlation of and dating of strata. Megascopic fossils would be crushed by the drill but the microscopic size of the foraminifera and other microfossils retained intact their individual characteristics.

The foraminifera, single-celled microscopic animals belonging to the Phylum Protozoa, were to be used in the Gulf Coast province and in the San Joaquin Valley of California. In the former province, regional structure maps were made by geologists on key paleontologic horizons such as the *Heterostegina, Textularia hockleyensis, Discorbis yequaensis* and other markers.

During this period, many micropaleontologists made significant contributions not only to the science itself but to its applications in the advancement of stratigraphic geology. These include Dr. Joseph A. Cushman, Dr. J. J. Galloway, Ellisor, F. W. Rolshausen, Hubert G. Schenck, Herschel L. Driver, M. C. Israelsky, Paul Applin, Esther Richards Applin, Marcus A. Hanna, and G. D. Hanna.

By 1941, there were about 500 persons definitely engaged in some sort of micropaleontologic or at least microstratigraphic work and

EARLY OIL FIRMS SLOW TO TAKE ON GEOLOGY

Today no professional group in the oil business has a higher standing than do geologists, geophysicists, and allied explorationists of the Southwest. They are numbered by the thousands and everybody in the oil business is interested in their activities.

But this was not always the case. Many early-day operators were slow in accepting the recommendations of the geologists. In 1918 the executive head of the largest operating company in Oklahoma and Kansas decided to employ a qualified geologist. Not wanting to be kidded by his associates within and outside the company, he had the geologist given another listing in the personnel records of the company.

Another Oklahoma operator, who now heads one of the most successful integrated companies, informed friends at a luncheon he had just employed his first geologist. He hastened to explain he was not sure this would prove to be a legitimate company expenditure so for the present he was paying the geologist's salary out of his own pocket. This was in 1920.

THE FIRST STEP IS RECONNAISSANCE

Before a general trains his big guns on the target, he determines by proper reconnaissance where it is. In the old days this was done by foot patrol and horse cavalry. Now it's done mostly by cameras and observers in high-speed aircraft.

The logical first step in oil exploration is also reconnaissance. Today, oil men call in Mayes-Bevan's gravity meter and/or seismograph crews before training their big guns — drilling — on the target. This will save them time and money, for they know that Mayes-Bevan's trained men and modern equipment will give them an accurate report on the areas which are most likely to produce oil.

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We of Mayes-Bevan are pleased to announce that in addition to our well-known gravity meter surveys, we now offer complete seismograph service. Our policy has always been to be FIRST in oil exploration. Initially with gravity meter surveys, now with the seismograph, we are continuing to serve that principle.

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Scouts watching the progress of an outpost well in the Lovell-Marshall sector of Logan County, Oklahoma, about 1925.

the total annual appropriation to support their activities was in excess of $2,500,000.

The practical micropaleontologist employed by the oil companies became principally a microstratigrapher. Not only did he devote his time to paleontologic aspects of the formations but he became a careful student of detailed lithology. He employed other tools such as detrital mineralogy, insoluble residues, thin-section analysis, grain-size sieve analysis, and petrofabric analysis.

Simultaneously, the equipment companies devised improved methods for taking cores in the unconsolidated sediments of the Gulf Coast. Thus micropaleontology, microstratigraphy, and advanced methods in sampling and coring marked significant strides in the science of subsurface geology.

The introduction of the electric log marks one of the most significant strides in the art of exploration. The story of the development of the Schlumberger world service organization dates back to the year 1919 when the French brothers, Conrad and Marcel Schlumberger, joined talents and opened a small consulting and research firm in Paris, France. The firm was devoted generally to the study of geological and mining problems.

The excellent reputation of Conrad Schlumberger as a professor and as an authority on problems of geology and mining, had, by this time, become widely known so that the new firm found itself immediately entrusted with large exploration campaigns in widely separated areas. The outlining of the Aricesti salt dome in Romania constitutes the first great success of applied geophysics in oil exploration.

Numerous surveys were made in Europe, the U.S.S.R., North Africa, and the Far East. The Alsatian plain, birthplace of both founders, was surveyed from 1926 to 1931. The geology of the Romanian plain was studied from 1933 to 1938.

The forerunner of electrical well surveying as we know it today was an experiment conducted in 1927 in Brittany. Through the courtesy of the "Administration of the French Telegraphs," cables were loaned for measurement of an electrical current sent into the ground through two electrodes located 200 km. apart. A study of the earth's crust down to a depth of 50 km. was the result. A new tool for probing the mysteries of the earth was in the offing.

From this experiment, the two brothers conceived the idea that more accurate information regarding the subsurface strata could be obtained if the measuring instruments could be lowered through the formations themselves instead of measurements solely at the surface

REFRACTION SEISMOGRAPH A BRILLIANT SUCCESS

—Forty salt domes found in 8 years

THE use of the refraction technique in prospecting for salt domes in the Gulf Coast region of Louisiana and Texas from 1926 to 1932 comprises one of the most outstanding successes in applied geophysics to oil prospecting. First introduced experimentally in 1924, accepted by the industry in 1926, it reached the peak of its Gulf Coast application by mid-1929. By the end of 1932, the application of the refraction technique diminished but not until after more than 40 salt domes had been surveyed at a total expenditure of less than $20,000,000, or an arithmetic average of about $500,000 per dome. It was temporarily supplanted by a sister method in the field of seismology—the reflection type. However, since 1946, it has been revived by a new refraction technique in areas like Lea County, New Mexico, where subsurface conditions make difficult the use of the reflection-type instrument.

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The first recording crew of Seismograph Service Corp. is shown on a road north of Stillwater, Okla., in the summer of 1932.

of the ground. The thought of using oil-well bore holes for this purpose naturally followed but many physical problems faced the enterprising prospectors. Instruments had to be designed to withstand temperatures and pressures encountered in such drill holes.

The new process was first called electrical coring as a possible substitute to mechanical coring.

The first electric log was run in a well in Pechelbronn field of Alsace. This log was a graph of the electrical resistivity of the rocks from the top to the bottom of the well. A steady electric current was passed into the rocks from a moving electrode lowered into the hole by means of an insulated cable. In moving through the rocks, this current gave rise to corresponding electrical potentials which were picked up by other electrodes located on the same insulated cable. At the surface, equipment measured these potentials and the corresponding values of resistivity calculated.

The mechanical equipment used in conjunction with the study was very simple in contrast to the elaborate portable electronic laboratories that feature well servicing today.

The cable used for lowering the instruments into the hole was wound on a wooden drum. This drum was driven by means of hand power and a bicycle chain. However, the readings were discontinuous. Nevertheless, the graph permitted high differentiation of the rocks due to the fact that rocks inherently vary widely in electrical resistivity.

The new tool became a correlation aid in that a trained geologist, by placing together two or more logs in an area, could determine the direction and rate of dip of underground strata and the existence and magnitude of faults.

Discovery of a phenomenon in 1931 was to mark a major forward step in electrical well surveying. While surveying a well in the Caucasus, Schlumberger engineers discovered a technique for locating permeable rocks that might contain oil. With the discovery of the condition that permeable rocks generally exhibit a natural self-potential greatly different from nonpermeable ones, came an addition of another curve supplementing the resistivity curve.

In 1932, two crews returned to the United States. From that time forward, electrical logging spread in every country of the world with astounding rapidity.

In the United States, Schlumberger Well Surveying Corp. was founded in 1934 to exploit the process in the domestic oil fields. In the rest of the world, the responsibilities of the Schlumberger activities were assumed by Societe de Prospection Electrique, which is in charge of electrical logging and by Compagnie Generale de Geophysique which is concerned with surface exploration.

E. C. Leonardon, who collaborated with the Schlumberger consulting firm in its beginning,

PERSISTENT PATTILLO!

—Flank oil eluded pioneer at Barbers Hill, Hockley

ONE of the little-told stories of the persistence of Pattillo Higgins in oil exploration on the Texas Gulf Coast is related to his vain efforts to find oil at both Barbers Hill and Hockley salt domes. After Spindletop blew in during 1901, the wildcatter, like many others of his day, used the same exploration ideas to try to find new oil fields. The magic formula, it seemed, was to find a mound protruding in the coastal plain, oil or gas seepages to "prove" the prospect, and drill "smack on top" of the salt core. It was the combination of the direct approach of oil prospecting in vogue at the turn of the century. But the curious twist to the story is that the crests of both domes were oil barren. Nature had hidden the oil on the flanks!

Higgins first went to Barbers Hill in 1902. He was attracted to it by its prominent elevation and the seepages of inflammable gas and sulfureted water found in shallow water wells near the top of the dome which would suggest the presence of a salt core. He drilled six wells from 1902 to 1906, all of which logged cap rock showing a little oil. It was not until September 14, 1918, that the first commercial oil well was found, the first in more than 16 years of exploration.

Disappointed with Barbers Hill, Higgins quit the area in 1906 and moved over to Hockley dome, northwest of Houston. In that year he drilled two dry holes on the John Warren farm. No. 1 went to 730 ft. and No. 2 quit at 863 ft. In all he drilled six wells in the ensuing 2 years without finding oil. Other companies likewise failed to find the elusive flank. Gulf drilled 19 dry holes from 1917 to 1923, and Texas Exploration had 20 failures on the dome from 1920 to 1924.

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The fundamental reason for the phenomenal growth of the oil industry has been multiple but distinctly individual effort. This is signified by the large number of oil producing companies which have operated independently through the years. The relatively free economy of the industry is more important today than ever before.

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Schlumberger is proud to have contributed to, and been a part of, the industrial development resulting from the Spindletop discovery.

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Schlumberger is proud of its record in pioneering and developing the first electrical log . . . and equally proud of the importance this discovery has proved to the oil industry. In the future . . . as proved by the past . . . extensive research always will be considered a vital phase of Schlumberger's service to the oil industry.

CONTINUES TO IMPROVE AND DEVELOP NEW SERVICES FOR THE OIL INDUSTRY

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A familiar sight in the Southwest during the World War I period was the surface geologist like the one shown above.

managed the firm's activities during the formative and later years.

Before long, two additional resistivity curves were added to the log which made it possible to foretell the nature of the fluid content of a permeable rock with an accuracy than was heretofore possible. These two resistivity curves were called the "third" or long normal curve, and the "fourth" or lateral curve.

Shortly thereafter, the first automatic recorders were placed in service. This eliminated the tedious task of manual recording and made for greater accuracy.

As time passed various other techniques were introduced to be run in conjunction with the electrical log and using the same basic logging equipment. Among these are percussion-gun side-wall coring; the photoclinometer for determination of the drift of a hole from the vertical; the dipmeter for determining the amount and direction of the slope of the strata at any vicinity of the hole; the induction-logging equipment for surveying in wells drilled with oil, oil-base mud or salty mud; the section gage for determining the size of the bore hole at any point; the mechanical sample taker that drills a core from the side wall in hard rocks at any desired depth; and the "MicroLogging" equipment, a recently developed device which locates more accurately the permeable zones in resistive rocks.

Major Geophysical Methods

Gravity Methods

Torsion balance. — Among the geophysical methods which were to come into the forefront in the 1920's was the Eotvos torsion balance. The instrument, as we know it today, was first invented and constructed by Baron von Eotvos, professor at University of Budapest. Bockh of Budapest surveyed local structures, principally salt domes, as early as 1917.

At the end of World War I, Anglo-Persian Oil Co. and Royal Dutch-Shell Oil Co. took up the instrument. Its first introduction into the United States and Mexico was due simultaneously to DeGolyer, then of the Rycade-Amerada oil group, and to the Royal Dutch-Shell.

The first torsion-balance instruments were received in New York on September 5, 1922. One of the first gravity surveys was made on the Spindletop dome early in December 1922.

The first successful torsion-balance prospect to be proved productive in the United States was the Nash dome in Fort Bend County, Texas, during 1924. A well was drilled in November 1925 which encountered cap rock at 648 ft. and rock salt at 943 ft. to prove the existence of a salt dome. Flank drilling resulted in the discovery of oil on this dome on January 3, 1926.

The Nash geophysical discovery was followed the same year by finding of Long Point, Clemens, and Allen piercement-type salt domes in the Houston district. Although several shallow domes were discovered on the Texas Gulf Coast prior to 1927, the principal impetus to-

THE ROLE OF THE U.S.G.S. IN SOUTHWEST OIL

THE U. S. Geological Survey played an important role in the development of the petroleum industry in the Southwest. It provided extensive data on regional geological conditions in the matters of areal geology, stratigraphy, and geologic structure, as a part of the survey's general task to ascertain the distribution, structural relationships, mineralogic character, economic value, and geologic history of the formations of each area surveyed.

Following the discovery of Spindletop oil field by Capt. A. F. Lucas in January 1901, the U.S.G.S. responded to the widespread demand for information concerning the geology of the Gulf Coastal Plain in Texas and Louisiana by assigning C. W. Mayes and William Kennedy to this problem. At the time very little was known concerning the formations underlying this region.

In the years that have passed since that early fundamental geologic work was accomplished, survey geologists have continued to do pioneer work in many parts of the Southwest. The results of geologic investigations by numerous geologists including men like Robert T. Hill, Alexander Deussen, C. H. Wegemann, N. M. Fenneman, G. D. Harris, and N. H. Darton, have provided basic geologic data needed for the growth and development of the industry.

C. M. (Dad) Joiner, 3 Mrs. Daisy Bradford, shown above, opened the great East Texas field

wards increased gravity prospecting was afforded by the discovery of the Sugarland dome, according to Sundt.

Gravity Meter Exploration Co., together with its predecessor, Torsion Balance Exploration Co., has one of the longest continuous records of geophysical exploration of any company now operating.

Torsion Balance Exploration Co. was founded in 1925 by W. G. Saville, J. P. Schumacher, A. C. Pagan, and R. Y. Pagan, and was the first American company to do contract torsion-balance surveys in the United States. With the advent of the gravity meter, Gravity Meter Exploration Co. was formed with the same partners. An experimental underwater gravity meter was developed by the company before the war, which led to the remote control underwater gravity meter which has been widely used on a world-wide basis.

The present partnership is composed of W. G. Saville, A. C. Pagan, Dr. L. L. Nettleton, who joined the firm in 1946, and M. W. Baynes.

The peak of torsion-balance exploration happened during 1929-1930, according to Nettleton. The depression of the 30's accelerated the decadence of this instrument as an exploration tool in petroleum prospecting.

Gravity pendulum.—Eckhardt with Gulf Oil started work on the gravity pendulum in 1929. The new instrument was first brought to Oklahoma but sharp reductions in exploration budgets limited early experimentation with it. However, with the introduction of the method to the Texas Gulf Coast, about 1932, the pendulum soon superseded the torsion balance as a reconnaissance method.

The first gravity pendulum for oil prospecting was developed about 1935 by Gulf. By the end of the year, Gulf shelved most of its torsion-balance projects. Other companies and consultants did likewise. In the 5-year period from 1935 to 1940, the torsion balance and pendulum were almost superseded by the gravity meter.

A resurvey of the Gulf Coast province with the gravity pendulum followed during World War II. Old prospects, first mapped with the torsion balance, were detailed with the new instrument. Gravity-meter work reached a peak in 1945 when 175 parties were in operation.

Gravity meter crews worked throughout the salt-dome belt of the Gulf Coast province, in the Rio Grande embayment, along the Balcones fault zone, and in the eastern gulf region.

A spectacular exploration program by the gravity meter is exemplified by Gulf in the State of Mississippi. Although Gulf's gravity work covered Louisiana, prior to 1936 that firm had not entered Mississippi.

In December 1936, a wildcat drilled by Sun Oil Co. at Midway near Hattiesburg drilled into anhydrite cap. Paul Weaver, in charge of Gulf's geophysical work, surmised that Sun had encountered a salt dome. Shortly afterwards, he ordered the transfer of a gravity-meter crew, then working at Lake Pontchartrain, to Hattiesburg. A few crew-weeks work outlined the gravity expression of a piercement-type salt dome.

The following year, Gulf organized three gravity-meter parties. A systematic gravity survey was conducted in the southern part of Mississippi in the ensuing 3 years. In 1 year as many as 40 salt domes were discovered by this instrument.

Eventually, Gulf Oil's survey covered the

RESULTS

In 1950 our clients drilled
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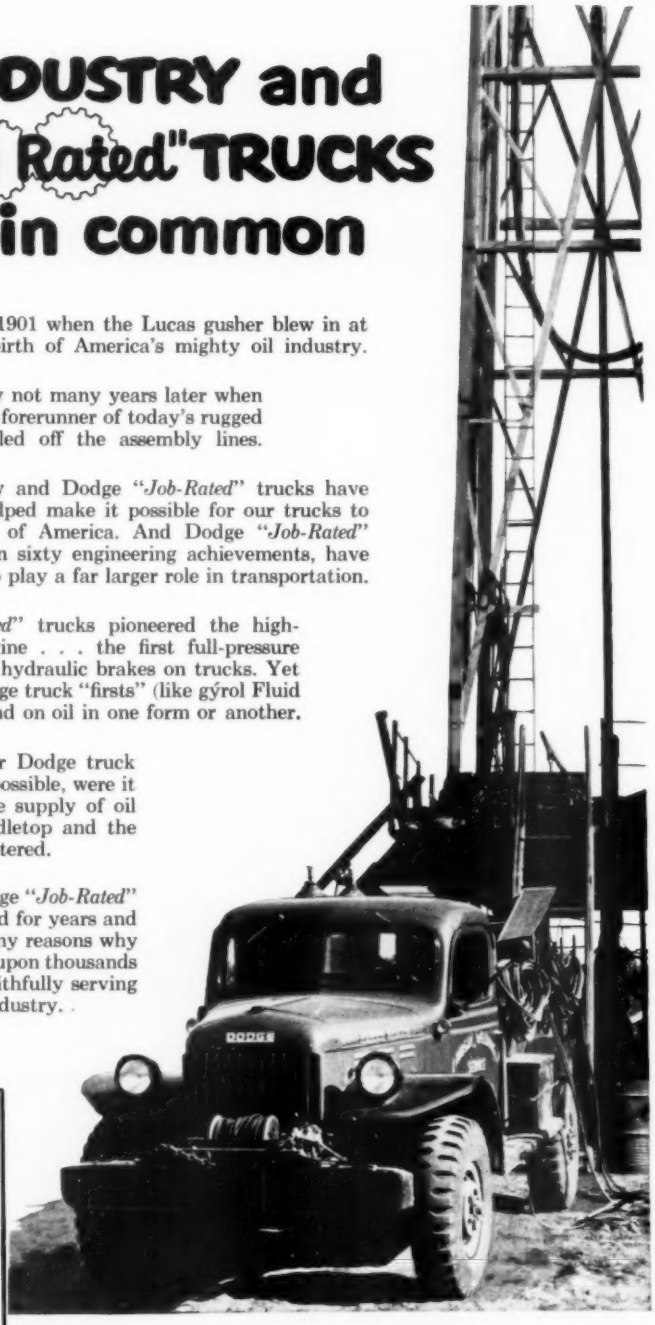
We realize that these and other Dodge truck "firsts" might never have been possible, were it not for the almost inexhaustible supply of oil that has been assured by Spindletop and the mighty oil industry which it fostered.

Yes . . . the oil industry and Dodge "*Job-Rated*" trucks have worked hand in hand for years and years. Perhaps this is one of many reasons why you will find so many thousands upon thousands of Dodge "*Job-Rated*" trucks faithfully serving every phase of the petroleum industry.



DODGE "Job-Rated" TRUCKS

The trucks that do the most for you

entire state. Gravity-meter crews worked farther along the eastern gulf region covering Alabama, Georgia, and part of the Atlantic Coast. Gulf, Shell, and The Texas Co. each made regional gravity-meter surveys of the entire area.

Seismic methods.—A new exploration frontier, the reflection seismograph, was opened in Maryland back in 1917. One Sunday afternoon, Dr. John Clarence Karcher, widely known in the Southwest, a graduate student at University of Pennsylvania, then working on his doctorate, was talking shop with Dr. W. P. Haseman at the latter's home in Chevy Chase, Md.

"Knowing the speed (of sound waves)" Dr. Karcher said, "and determining the travel times, we should be able to calculate the depth to the subsurface reflecting formation."

"Karch," his colleague replied, "I think you've got something."

The "something" was a plan for using sound waves to map structures far below the earth's surface. Here was the formula: *D equals one-half the square root of the quantity VT squared minus X square.*

It worked this way! Imagine an inverted triangle with equal sides. The scientist used a dynamite shot and recording instrument to measure the distance from the triangle's base (earth's surface) to its apex, the reflecting point on the structure, far underground. Where the structure is highest, oil may be found.

"My first attempt to record sound or seismic reflections," Karcher writes, "was made 2 years later in the summer of 1919."

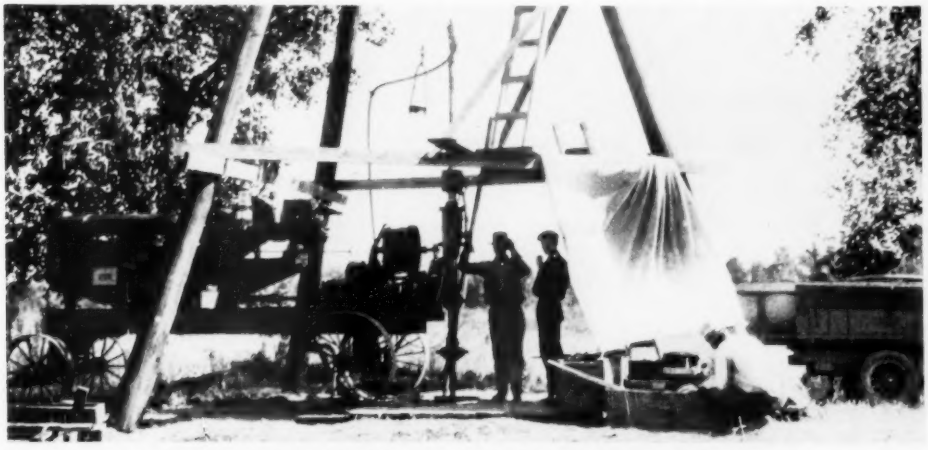
"I used a bi-filar type of galvanometer and weighted carbon-button type of detector. These experiments were made near Washington, D. C."

Barton states that the initial impetus to the present extensive use of seismic methods was due largely to L. Mintrop and his "Seismos" Co. of Hannover, Germany. Working as a junior colleague of Weichert of Gottingen, Mintrop developed his instruments and techniques during World War I. By 1921, he had demonstrated the potentiality of the refraction method but apparently had not done sufficient field surveying of geologic structure.

Marland Oil Co. brought the Mintrop refraction method to the Mid-Continent about 1923, and into the Gulf Coast in March 1924. A second crew, organized a short time later for Gulf Production Co. under the direction of L. P. Garret, discovered the Orchard salt dome in Fort Bend County late in 1924. DeGolyer states that this was the first seismic oil discovery to be made in the United States.

Meanwhile, the scene switches back to Dr. Karcher who was then working on high-speed submarine cables and loading coils for long-distance lines. Yet the shreds of his early dreams of 1921 floated tantalizingly before him. Conferences held between Karcher, DeGolyer, and Barton, first in New York, and later in St. Louis, resulted in the formation of Geophysical Research Corp. as a subsidiary of Amerada Petroleum Corp. The first employe of the new firm was Eugene McDermott. Others destined for distinguished careers in geophysics with G.R.C. were F. M. Kannestine, E. E. Rosaire, B. B. Weatherby, H. B. Peacock, Henry Salvatori, and Roland F. Beers.

The work of Petty Geophysical Engineering



One of the wagon-mounted core-drills used in the northern Mid-Continent fields about 1919.

Co. in developing competent refraction equipment was recognized by the industry. In March 1930 Humble Oil & Refining Co. purchased a complete set of instruments and trucks which it sent to West Texas for work in the Permian basin, and subsequently in the Delaware basin.

East Texas campaign.—Another striking example of the application of the refraction seismograph to a successful and concerted salt dome mapping campaign is that which was conducted in the East Texas basin in 1927.

M. A. Davey of Palestine, Tex., drilled a wildcat 14 miles northeast of that town but on the Neches River near the Anderson-Cherokee county boundary. Drilling revealed the existence of a pronounced local uplift. Coring operations by Davey outlined the local structure but Humble rechecked the anomaly with the refraction seismograph to prove the presence of a salt dome. Humble found oil in the Woodbine sand on the flank of this dome on March 21, 1927.

This discovery was to initiate an exploration campaign in the East Texas basin which was engaged in by Gulf, Pure, Amerada, and Roxana (now Shell) as well as by Humble. Ten salt domes were discovered during the first 9 months of 1927 by seismograph crews carrying the Mintrop instrument and that designed by the Bataafsche (Royal Dutch-Shell) interests.

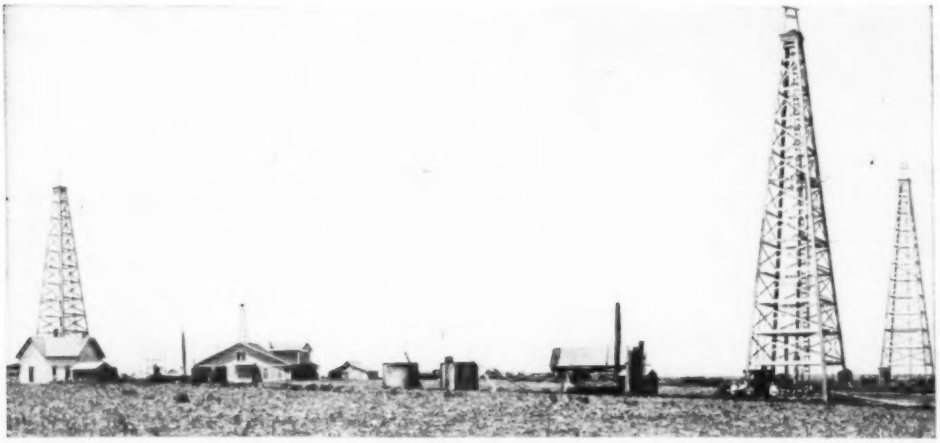
In 1925, Karcher took up the reflection method and made it commercially practical. He applied the radio time break, sound surveying, and electrical recording. In 1926, a G.R.C. crew mapped the first structure to be outlined by the reflection seismograph. The first oil to be discovered in commercial quantities from a reflection seismograph structure is described by Karcher as being Edwards pool in the Seminole area of Oklahoma. This was a 1929 G.R.C. discovery under the direction of Weatherby; oil was found the following year on this anomaly.

During the spring of 1932, Independent Exploration Co. was organized by a group of technical men selected from G.R.C. which was then withdrawing from seismograph contracting in the Gulf Coast province. These men were pioneers in refraction-seismograph exploration and were responsible for the discovery of a number of salt domes during the extensive exploration program utilizing that method which lasted from 1925 to 1932. Included in this group were Kannenstine, Rosaire, A. L. Smith, T. I. Harkins, H. F. Shore, J. W. Flude, and J. H. Crowell.

The rise of the application of reflection seismograph forms one of the most significant chapters in petroleum prospecting. During 1929, the improved instrumentation and methods resulted in the discovery of three oil fields in rapid succession.

The success of Independent Exploration Co. during the early part of its history is remarkable. During the first 6 years of its existence from 1932 to 1938, clients found 25 oil fields in the Gulf Coast as the result of surveys by IXL surveys. Reports state that this is 32.2 per cent of all fields found in the Gulf Coast province during this period.

From four reflection crews in operation in the United States at the end of 1929, the popularity of reflection seismograph prospect-



The discovery well of famous Burkburnett oil field was the derrick shown at the right foreground on the S. L. Fowler farm: it was completed in Wichita County, North Texas, on July 29, 1918.

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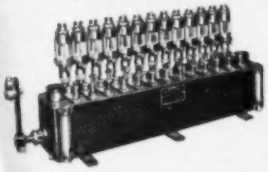

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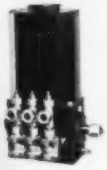

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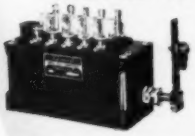

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A modern reflection seismograph crew, shown above, is Stanolind Oil & Gas Co.'s Party 42, operating in the Texas Gulf Coast area. The $30,000 recording truck in the background is the costliest item of the total investment of $90,000.

ing rose so that, 8 years later, there were as many as 220 reflection crews in operation. The number of these crews remained relatively constant during the period of 1938-41; after this period there was a gradual increase to a peak of 520 seismic crews during 1948.

In the development of the intricate instrumentation and techniques related to seismic exploration, Burton C. McCollum, Houston, was prominent in the Rio Grande Valley of Texas about 1934. Other pioneers in applied seismology include Dr. C. A. Heiland, Denver; Sidon Harris and R. H. Dana, Fort Worth; Gerald H. Westby, Tulsa; John A. Gillian and Walter H. Amis, Jr., Dallas; and J. C. Pollard, Houston.

The development of undersea seismometers, concentrically integrated with an undersea cable with a power-driven reel on which an entire spread is spooled, is a contribution of National Geophysical Co., organized in 1935. In the instrumentation field of geophysical galvanometers, a real improvement was made by Century Geophysical Corp., of Tulsa, in recent years. A high success ratio in the Julesburg basin as well as in the Southwest is reported for General Geophysical Co. of Houston.

Magnetic Methods

Magnetometer.—The forerunner of the present-day magnetometer is the dip needle or so-called dip compass which was applied to iron-ore exploration in Sweden back in the seventeenth century. Tiberg of Sweden invented the so-called dip compass which was easy to operate but failed to detect small changes in the earth's magnetic field.

In 1915, Adolf Schmidt constructed a magnetometer sensitive enough to measure changes of less than 5 parts in 100,000 of the total intensity of the earth's magnetic field.

The magnetometer measures variation in the magnetic field of the earth caused by the presence of magnetic rocks, or magnetic portions of geologic structures. Heiland groups the applications of the magnetometer as follows: (1) old crystalline massives; (2) anticlines; (3) faults; (4) intrusions, veins, and zone of contact; (5) mineral accumulations; (6) iron ore; (7) rare metals; (8) salt domes, provided there is magnetic contrast, etc.

When the magnetometer was introduced into the United States in 1924, it was welcomed with open arms. The inexpensive, seemingly easy and fast field work with the magnetic method (as compared to the costly and laborious work of other geophysical methods) made it a preferred instrument for a time. Hundreds of magnetometers were in use in the United States within a few years after its introduction. It appeared that a high-school graduate could be entrusted with its operation. Immediately, a far-flung search for magnetic "highs" was started.

W. P. Jenny, of Houston, and W. W. Barrett, of Shreveport, were among the best-known scientists working with the magnetometer. Jenny made extensive regional studies along the entire Gulf Coast and made special regional analyses along the Sparta-Wilcox trend. Other workers in the field of magnetic exploration in the Southwest include Sparagen, Barton, Clifford, and Collingwood.

Magnetic-high trends define important fields of the Jackson trend including Conroe, Tomball, Livingston, and Spurger. These anomalies are also gravimetric minima. Jenny believes that these are deeply buried salt domes along anticlinal structural axes.

The use of the magnetometer waned as other geophysical tools developed high resolving power such as the reflection seismograph and improved gravity meter. However, the airborne magnetometer was introduced into the oil industry about 1946, after being blanketed under military secrecy regulations for 5 years. Economy, speed, and continuous recording were advantages of the airborne instrument over the point-to-point magnetometer of earlier prospecting days.

The airborne magnetometer, currently in use, consists of a continuously recording electronic instrument and a continuous strip camera which records the position of the plane with reference to established bench marks and keys the magnetic profile to the ground position.

The speed of magnetometer surveying from

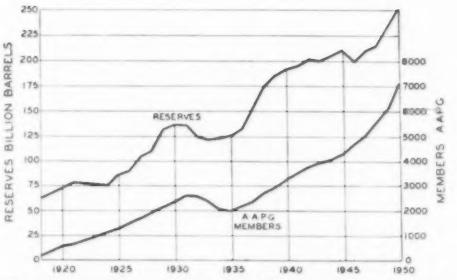
the air is of particular advantage over areas of inaccessible or rough terrain, as in mountainous regions. Another practical application of the airborne magnetometer are the extensive surveys being made in the Continental Shelf regions of the Gulf Coast where hundreds of square miles of submarine terrain are surveyed daily for locating magnetic anomalies. The use of Shoran or short-range radio navigation provides the instrumental answer to determination of the exact position of the airplane over the water. Thus the magnetic method staged a comeback through improved instrumental sensitivity and a new, unique method of transporting the instrument itself.

Radio-Activity Methods

In the spring months of 1936, John C. Bender made an invention which covers many phases of the present radioactivity well-logging* business. R. E. Fearon in 1938 invented as an improvement on Bender's discoveries, a form of neutron well-logging corresponding with present commercial practices†. To develop and practice inventions relating to radioactivity well logging, Well Surveys, Inc., was organized in Tulsa in May 1939. Well Surveys, Inc., received assignment of the Fearon patent, and shortly acquired a license to use Bender's invention. The first gamma-ray log to be published was presented in Geophysics IV No. 2, March 1939, by Howell and Frosch, of Humble Oil & Refining Co. The first published logs from Well Surveys, Inc., were released in The Oil and Gas Journal, February 22, 1940, by S. A. Scherbatskoy and G. H. Westby.

The first commercial gamma-ray well-logging service was performed on a well in Polo field, in April 1940. The first published neutron log was presented by Bruno Pontecorvo, in The Oil and Gas Journal, September 11, 1941. The first commercial service of neutron logging also began through the efforts of Well Surveys, Inc., in the fall of 1941. W. G. Green, founder and president of Well Surveys, Inc., has been assisted by C. E. Duller, vice president since the organization began. Others who have contributed to the Tulsa development include Jacob Neufeld, Gilbert Swift, and Paul Wolff. The course of the radioactivity well-logging business was characterized by relatively slow growth from 1940 to 1944, and much more rapid acceptance since 1944. Approximately 90 per cent of all radioactivity logs have been made since that year. Approximately one-half of all radioactivity and neutron logs have been made since 1948.

*U. S. Patent 2133776, Reissue 23226. †U. S. Patent 2349712.



This graph shows a striking correlation between the growth of proved developed crude-oil reserves in the United States and the rise in the number of members of the American Association of Petroleum Geologists.

To date, about 35,000 radioactivity well logs have been made in the United States, Mexico, Canada, Venezuela, Trinidad, and Argentina, principally by Lane-Wells Co., Seismograph Service Corp., and Geotecnica, S.A., licensees of Well Surveys, Inc.

Stratigraphic Prospecting

The geophysical phase of structural prospecting opened the deeper portions of the vast basins of the Southwest for prospecting and in so doing revolutionized exploration for petroleum. However, geological prospecting did not experience a similar renaissance, according to Rosaire.

The diminishing returns in structural prospecting, and the untapped possibilities to be found in stratigraphic prospecting were called to the attention of the petroleum industry in a striking way by A. I. Levorsen, prominent Mid-Continent geologist, now engaged in research activities. In a presidential address before the A.A.P.G. in April 1936, he pointed out the dangers that might result from continuation of specialization in structural prospecting. Levorsen used the striking analogy of well-armed hunters who persisted in going after rapidly vanishing small game in the same area where the poorly equipped natives brought in elephants with surprising regularity.

He developed that there were often associated with unconformities what is known as "wedge belts of porosity"—areas where sands grade into shales, or porous limestone changes to nonporous limestone updip and in the form of a long wedge. Facies changes have long been noted in geologic literature but Levorsen dramatically synthesized the entire field of stratigraphic prospecting, the impact of which has not been fully recognized.

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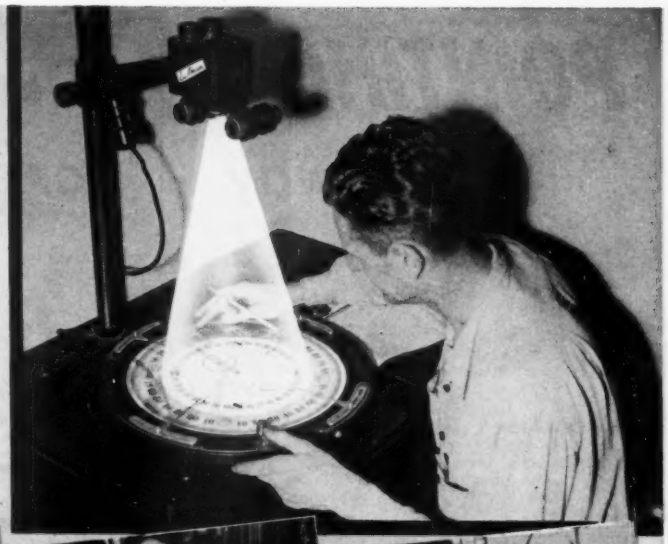

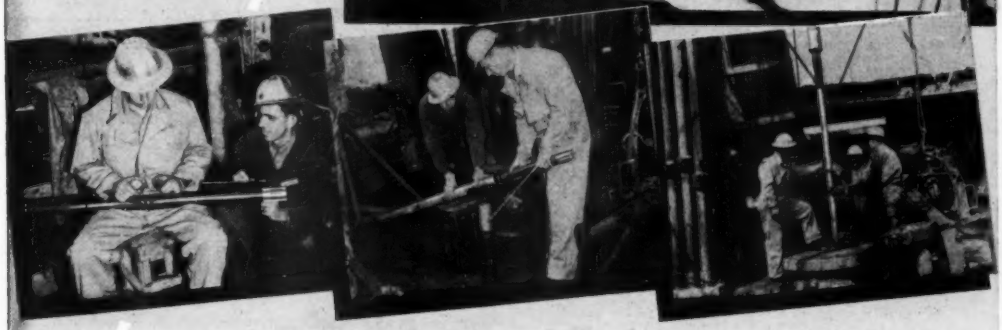

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SOUTHWEST Exploration PERSONALITIES

Here are abridged digests of the careers of some of the men who have contributed most notably to the science of finding oil in the Southwest.

Donald C. Barton was a pioneer on interpretation of corrosion-balance results in their relation to structure. He was research geologist and geophysicist for Humble Oil & Refining Co., Houston, from 1934-39, and was a president of American Association of Petroleum Geologists. (Died 1939).

Roland Frank Beers, head of the fuel-resources department of Rensselaer Polytechnic Institute, is president of Geotechnical Corp., Dallas, is a partner in the firm of Beers & Heroy. He entered the oil business in 1928.

Ben C. Belt, director of Gulf Oil Corp., began his geological career with Mexican Gulf Oil Co. in 1916. He was chief geologist in Gulf's Fort Worth and Houston districts until 1933, when he was named assistant to the vice president. Belt was named vice president of the Gulf Coast production division in 1950.

L. W. Blau, research consultant for Humble Oil & Refining Co., Houston, since 1942, was named director of geophysical research in 1930 and appointed head of geophysical and production research in 1942.

A. M. Blow served as first vice president and general manager of Amerada Petroleum Corp., Tulsa, and joined the firm in 1920. He formerly was head of the land department after leaving Producers & Refiners Co.

Frank Clark, independent geologist and consultant to Ohio Oil Co., Tulsa, entered the oil business with Wiser Oil & Petroleum Exploration Co. at Sisterville, W. Va., in 1919. He joined Ohio Oil in 1923 and became vice president in 1936. He retired in 1946.

Henry C. Cortes, Dallas, in charge of Magnolia Petroleum Co.'s geophysical exploration, entered the oil business as a roughneck in Texas in 1922. He joined the old Vacuum Oil Co.'s geological department in 1924.

Ira H. Cram, vice president of Continental Oil Co.'s exploration and production department, Houston, joined the firm in 1949 following employment with Pure Oil Co. for 23 years. He was named vice president of the exploration division when joining the firm and was named to his present post in March 1950.

A. R. Denison, vice president of Amerada Petroleum Corp., Tulsa, joined the firm in 1922 and became chief geologist in 1937. He was appointed to his present position in 1950.

Alexander Deussen, Houston consulting geologist, is a Sidney Powers Memorial Medalist. His geological work dates back to 1908 when he was with the U. S. Geological Survey. He was vice president and geologist in charge of Gulf Coast operations for the old Marland Oil Co. from 1924-28.

Opie Dimmick, president of Century Geophysical Corp., Tulsa, first entered the oil industry in 1928 at Houston, where he joined Humble Oil & Refining Co.'s seismic department. In 1935 he joined Carter Oil Co., resigning in 1945 to organize Century Geophysical.

E. A. Eckhardt, vice president of Gulf Research & Development Co., was assistant chief of the old Marland Oil Co.'s research department from 1925 to 1928 before joining Gulf.

F. Julius Fohs, Houston geologist and independent operator since 1912, has directed the finding, development and operation of many oil pools in Texas, Oklahoma, Louisiana, Mississippi, and Wyoming.

James H. Gardner, president, Gardner Petroleum Co., Tulsa, a graduate of University of Kentucky, formerly was with the U. S. Geological Survey. Serving as a consulting geologist until 1919, he became president of Gardner Petroleum in 1919.

Andrew Gilmour, chief geophysical supervisor for Amerada Petroleum Corp., Tulsa, joined the firm in 1922. He received degrees from Queen's University, Belfast, and from National University of Ireland.

Frank Goldstone, Shell Oil Co., a native of Whittingham, England, was a geophysicist with the old Roxana Petroleum Corp. in Texas and Louisiana from 1926 to 1928, before joining Shell. He was named chief geophysicist for Shell in 1929.

Charles N. Gould was an outstanding figure in the development of geological knowledge in the Southwest as a teacher, field geologist, and geological consultant. He was first director of the Oklahoma Geological Survey.

Cecil H. Green, vice president of Geophysical Service, Inc., Dallas, joined the firm in 1930. He was named district supervisor in 1936, and vice president in 1941.

Lee Hager, graduate of Harvard University, discovered several domes in Louisiana and Texas, and became one of the country's best-known geologists. (Died 1944).

Sidon Harris, president of Southern Geophysical Co., Fort Worth, taught at several universities before joining Humble Oil & Refining Co. He later left that firm to complete graduate work, and in 1934 and received a Ph.D. degree at Texas University.

W. B. Heroy, of Beers & Heroy, Dallas, and vice president of Geotechnical Corp., Dallas, entered the geological field in 1908 with the U. S. Geological Survey. He joined Sinclair Consolidated Oil Corp. in 1919, where he became chief geologist in 1929. Later he was president of Pilgrim Exploration Co.

Eugene Holman, president of Standard Oil Co. (N. J.) since 1944, joined Humble Oil & Refining Co. in 1921. Five years later he became chief geologist, and in 1928 was transferred to the parent Jersey firm. He was elected director in 1940.

J. V. Howell, geological consultant and independent oil operator, Tulsa, entered the oil business in 1916 as a geologist for The Texas Co. A graduate of University of Iowa, he worked as geologist for the old Gypsy Oil Co. and Marland Oil Co. before joining Texaco.

W. P. Jenny, consulting geologist and geophysicist of Houston, is a native of Berne, Switzerland. He became associated with Shell Petroleum Corp. in 1925, and in 1930 joined Magnolia Petroleum Co., remaining there until 1932.

E. W. Johnson, president of General Geophysical Co., Houston, organized the firm in 1935. After attending University of Texas, he went with Texas Power & Light Co., and in 1926 joined Shell Oil Co.

Sidney A. Judson, Houston, Texas Gulf Refining Co. geologist, entered the oil industry in 1917. He was a participant in the geology and development of the first salt dome (Barbers Hill) to yield commercial oil under overhang.

F. M. Kannenstine, Kannenstine Laboratories, Houston, was named a director of Geophysical Research Corp.'s laboratory in 1922 and vice president in 1945. For the next 5 years he served as a member of the firm of Rosaire & Kannenstine.

Frederic H. Lahee, research counselor for Sun Oil Co. in Dallas, is best known for his book, "Field Geology." He is a member of the American Petroleum Institute's committee on crude-oil reserves, and chairman of the American Association of Petroleum Geologists' committee on exploration.

A. I. Levorsen, professor of geology at Stanford University, was geologist for various oil companies in the Southwest between 1917-35. In 1936 he entered consulting work in Tulsa.

Edmondson Dale Luman was an independent geologist in Tulsa beginning in 1943. Prior to that he had been chief geologist for Atlantic Refining Co. at Dallas. He attended University of Oklahoma and University of Kansas, and began his first field work with Roxana Petroleum Corp. in 1918. (Died 1944).

George Charlton Mason, Tulsa, was affiliated as a geologist with Mexican Gulf Oil Co., Gulf Refining Co. of Louisiana, and Gypsy Oil Co. He was a past-president of American Association of Petroleum Geologists and had been vice president of Schermerhorn Oil Co. (Died 1940).

L. F. McCollum, president of Continental Oil Co., Houston, majored in geology from University of Texas and joined Humble Oil & Refining Co. in 1925. He later transferred to Carter Oil Co. of chief geologist and after advancing to president of Carter, was transferred to Standard Oil Co. (N. J.), as coordinator of producing activities.

Eugene McDermott, chairman of Geophysical Service, Inc., Dallas, was field supervisor for Geophysical Research Corp. from 1923-30. He became president of Geophysical Service in 1930.

R. S. McFarland, vice president and general manager of the Mid-Continent Division, Seaboard Oil Co., Dallas, was geologist for Empire Gas & Fuel Co. from 1916 until entering consulting work in 1918. From 1920-30 he was with Twin State Oil Co. (Sun Oil Co.).

C. L. Moody has been associated with Ohio Oil Co. since 1918. Past president of the American Association of Petroleum Geologists, he is well

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known as a specialist on Gulf Coast area stratigraphy and petrology.

L. L. Nettleton, Houston, was a geophysicist with Gulf Research & Development Co. from 1928-46, and since that time has been a partner of Gravity Meter Exploration Co., Houston.

H. B. Peacock, president of Geophysical Surveys, Inc., Dallas, was a party chief for Geophysical Research Corp. in Oklahoma from 1926-30. He joined G.S.I. in 1934 and became vice president.

O. S. Petty, president and chief engineer of Petty Geophysical Engineering Co., San Antonio, since 1925, is a pioneer in geophysical research as applied to exploration for oil.

Sidney Powers was chief geologist for Amerada Petroleum Corp. from 1919-26. He was associated with early work of geophysicists in the Southwest and played an important part in the development of seismograph work. (Died 1932).

Norman H. Ricker, senior research physicist for Carter Oil Co. since 1938, established Humble Oil & Refining Co.'s geophysical department in 1923, where he stayed on as department head until 1925.

E. E. Rosaire, consulting geophysicist, Houston, was field superintendent for Geophysical Research Corp. from 1925-32. From 1932-36 he was president and general manager of Independent Exploration Co. He became senior partner of Geochemical Surveys, Inc., Houston, in 1942.

W. M. Rust, Jr., Houston, head of geophysical research for Humble Oil & Refining Co. since 1937, received his Ph.D. degree at Rice Institute in 1931. He joined Humble in 1934.

C. W. Tomlinson, Ardmore, Okla., is known as a specialist on complicated geologic structure and stratigraphy in southern Oklahoma. He has been active in Southwest geology since 1918.

O. H. Truman, retired consulting geophysicist, Houston, was with Humble Oil & Refining Co. from 1924-31. He is credited with developing the first successful gravity meter.

Benjamin B. Weatherby, president of Geophysical Research Corp., Tulsa, and vice president in charge of exploration, head of the geophysical department, and director of Amerada Petroleum Corp., joined G.R.C. in 1925 as a party chief.

Paul Weaver, chief geophysicist for Gulf Oil Corp., Houston, directed the first torsion balance and first seismograph operations in Mexico in 1923. He has been with Gulf since 1926.

Gerald H. Westby, president of Seismograph Service Corp., Tulsa, was resident geologist in Algeria for S. Pearson & Sons, of London, until 1924, when he joined Empire Oil & Refining Co. He has been associated with S.S.C. since 1933.

W. E. Wrather, director of the U. S. Geological Survey, Washington, D. C., was a geologist with Gulf Producing Co. and J. M. Guffey Petroleum Co. from 1908-16, and later a consulting geologist specializing in Permian stratigraphy of the Southwest and geology of northern Texas oil fields.

Ralph D. Wycoff, Gulf Research & Development Co., Pittsburgh, was geophysicist with the old Marland Oil Co. from 1926 until he joined Gulf in 1929. He was named chief of geophysical research and development in 1945.

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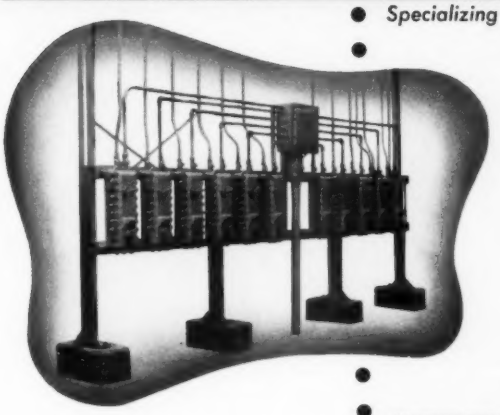

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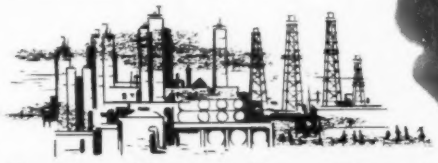

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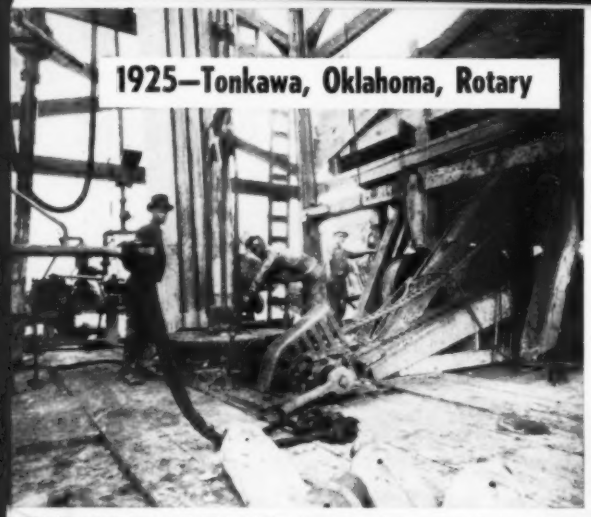
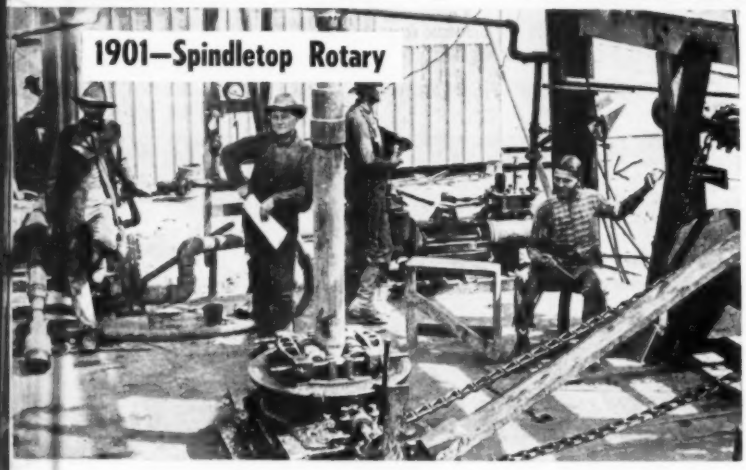
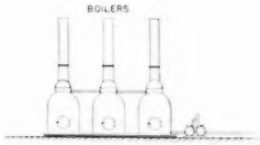






Southwest, U.S.A.—BIRTHPLACE

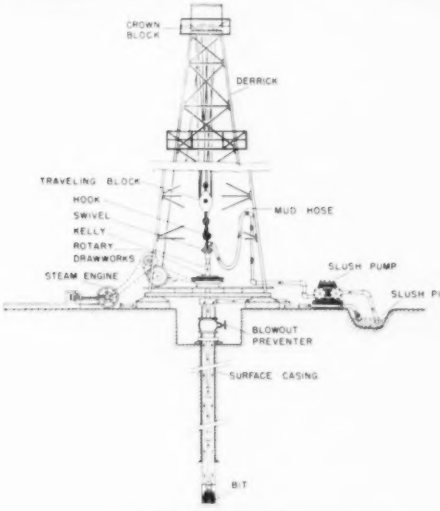
CAPTAIN LUCAS drilled his Spindletop, Texas, discovery well with a rotary rig. This seems of little significance today when rotary rigs are being used throughout the world and are drilling the majority of wells. However, in 1901 a rotary drilling rig was an oddity. Its limited use had been confined to drilling for oil in the Corsicana, Texas, field and for water in various states.

In the 42 elapsed years from Col. Edwin Drake's historic "birth of the industry" well in Pennsylvania to the Lucas gusher, other drilling methods were more popular than the rotary. Some drilled for oil by boring with an auger. Others simply drove a pipe with a pointed end into the ground. However, the more ordinary procedure was to use cable tools.

Cable-tool drilling.—By no means a new art, cable-tool drilling was employed by the Chinese prior to 1700 A.D. in the drilling of brine wells to depths of more than 1,500 ft. Using

1938—First Gulf of Mexico Producer

1945—West Texas Portable Rig



1951—Gulf Coast Automatic Rig

by Leigh S. McCaslin, Jr.

OF ROTARY DRILLING

the same principles, the United States oil industry in its 90 years of existence has evolved the American "standard" rig and also portable cable-tool rigs. These are the two commonly used types of cable-tool rigs today.

The cable-tool method, whether in a standard or a portable rig, consists essentially of making hole by raising a bit attached to the end of a steel cable and then allowing it to fall free. The bit pounds or fractures the rock or earth to be penetrated. The material broken loose by the bit is removed from the hole by

Here is the story of 50 years of oil drilling in Southwest, U.S.A. It is a story of men, materials, and methods. In it are narrated the events that led to the region becoming the Magic Empire of Oil. Old timers will find themselves becoming nostalgic with its reading. Younger men will be stirred by the realization that they, too, may be helping to make the history that will be recorded in the year 2001.

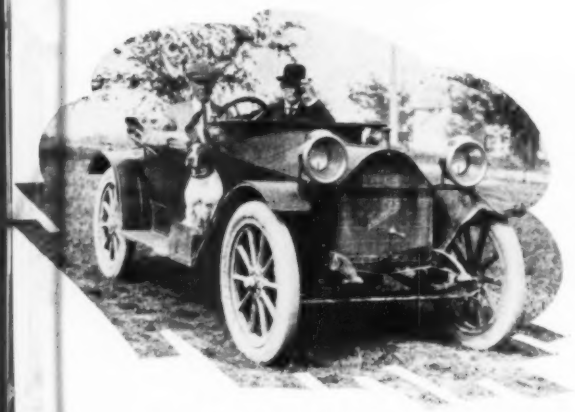
means of a bailer on a separate steel cable from the bit.

As the hole is drilled deeper, successively smaller-diameter strings of pipe are set into the hole. The purpose of this pipe is to prevent gas or water from entering the hole from penetrated formations.

The greatest improvement in cable-tool rigs since 1901 has been the use of steel where iron and manila rope were formerly used. Improvements in recent years have consisted primarily in building heavier equipment suitable for the deeper holes to be drilled, and in designing more portable types of cable rigs. Also, detailed engineering study has been made of such factors as stroke length to determine the best operating practices.

At this time, cable-tool drilling is confined almost entirely to relatively shallow operations in hard formations, to cleanout work on previously drilled wells, and for completing wells in fields where rotary-drilling fluids lower the producing capacity of the formation.

An early-day blowout at Sour Lake field, Texas, in 1902 completely destroyed the derrick and drilling equipment.



Above: John H. Galey, of the famous wildcatting firm of Guffey & Galey, is shown here on a lease near Chanute, Kans., in 1914 with his nephew, Thomas M. Galey. Guffey & Galey were the best known Southwestern wildcatters in the early days of the industry. They bought production at Neodesha, Kans., in 1892, again at Corsicana, Tex., in 1894, and then were responsible for the most significant well of the century at Spindletop, Tex., in 1901. It was Guffey & Galey who backed Captain Lucas and his Spindletop well, carrying the captain for one-eighth interest. From Guffey & Galey's Spindletop operation came J. M. Guffey Co., predecessor company of today's huge Gulf Oil Corp.

Henry Kelly, a well-known pioneer in the development of cable-tool rigs, was founder of The Armstrong Co. In 1867 he invented the "cam and treadle" portable drilling machine, the forerunner of the modern spudder. His company produced one of the first wire-line rigs in 1925 and in 1929, the first all-steel cable-tool rig. In 1933, The Armstrong Co. was acquired by Bucyrus-Erie Co.

Rotary Popular

Generally speaking, most operators have decided that rotary drilling is cheaper on a per well basis than cable-tool drilling. This is despite the fact that rotary rigs are more expensive to purchase and have a higher operating cost per day. The greater efficiency of the rotary, under most drilling conditions, offsets these factors.

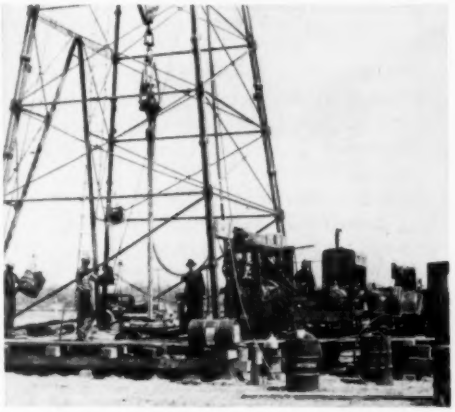
Rotary drilling came into general use in

Horses were the mainstay of oil-field transportation in the early 1920's as this picture at Breckenridge, Tex., proves. In the left foreground is John Stratch, well-known contractor of the day.

the early 1920's. It gained its foothold in the soft-drilling area of the Gulf Coast and California. It has only been in the past 20 or 25 years, however, that rotary drilling has become so emphatically predominant over cable-tool drilling. R. E. Collom, in the U. S. Bureau of Mines Bulletin 201, "Prospecting and Testing for Oil and Gas," published in 1922, states:

"Approximately 100,000 of the 109,000 wells estimated as completed in the United States during 1914-18 were drilled with cable tools, which are used in all eastern fields, the Mid-Continent field, Rocky Mountain fields, part of Texas and Louisiana, and for all pioneer work in California. Cable tools are especially adapted to prospecting."

R. S. Knappen, of Gulf Oil Corp., recalled



Above: The "spark-plug" rotary rig was just beginning to catch on in the industry when this truck-mounted power rig was built in 1932, and put into operation in Archer County, Texas. It had its origin when L. T. (Bobby) Burns, Wichita Falls contractor, approached Wilson Manufacturing Co. with the idea of building a power rig, complete with pump, all mounted on one truck. Shown in the photo, taken on the first installation of this rig, is John Wilson, Wilson Manufacturing Co., pointing to the rotary table. The driller standing between the engine and the draw works is S. W. (Frenchie) Petre, now a well-known oil operator of Wichita Falls.

Below: Within a few weeks after discovery of oil in Burkburnett, derricks sprang up throughout the town. This view, looking north, shows the main road from Wichita Falls leading into Burkburnett's business district. A city school under construction when the picture was made is just to the right of the highway. The No. 1 Fowler, which opened the prolific pool, is lost in smoke and haze of the background.

Transportation was a major problem during the Seminole boom. Peak production from Greater Seminole came on July 30, 1927, when the 10 major fields of the area were making 527,400 bbl. of oil daily.

in 1948 that "Only 20 years ago we drilled with rotary at Seminole, Okla., to a depth of 3,500 ft. and there standardized, regardless of the formation which had been penetrated at that depth. Experience during the 2 preceding years had shown that wells could be completed earlier and cheaper if the rotary was abandoned at a depth of 3,500 ft. and the remaining 600 or 700 ft. of hole were made with cable tools."

Birth of Rotary Drilling

THE cable-tool drilling method was almost universal in the oil fields until the advent of the rotary method of drilling. Rotary drilling consists basically of fastening a bit, or drilling tool, to the lower end of a pipe, turning the pipe, and pumping a fluid down the inside of the pipe and allowing it to return to the surface between the outside of the pipe and the wall of the hole being drilled. As the bit progresses downward, the fluid carries the cuttings of the bit to the surface.

The rotary-drilling outfit is reported to have entered the petroleum industry through the development of equipment that was first built by M. C. and C. E. Baker, water-well drilling contractors of South Dakota.

(A search by Pennington revealed that a number of patents pertaining to rotary drilling were issued prior to the Baker brothers introduction of the system to the oil industry. A French civil engineer, Leschot, used a diamond-studded bit and rotary drilling in 1863. Summers was granted a patent in 1869 covering a combination rig with rotary table, bevel-gear drive, kelly, and kelly bushing. In 1873, Cross invented a circulation system to be used with rotary drilling. The complete conception of the hydraulic rotary system as employed today appears in U. S. Patent 443069, filed by Chapman in 1887.)

This crude rotary-drilling device of the Baker brothers was brought from their Dakota work to Corsicana, Tex., and American Well & Prospecting Co. realized the possibilities for using it in the soft soils encountered in Texas and undertook to adapt it to the needs of the drilling contractors there.

Development of Rotary Drilling

STEAM was used as the source of power in Captain Lucas' rig at Spindletop 50 years ago. Steam equipment has been generally preferred and predominantly used until very recent years. This predominance over other power sources is based on several factors, including (1) The inherent speed and torque flexibility of a steam engine, (2) availability of low-cost natural gas in many drilling areas, and (3) availability of low-cost water in many drilling areas.

Abundant natural gas and water have made the steam rotary rig particularly popular in the Gulf Coast area. Only in recent years have power rigs entered the area in sizable numbers.

The steam rotary rig used by Lucas at Spindletop consisted of a Chapman 12-in. rotary

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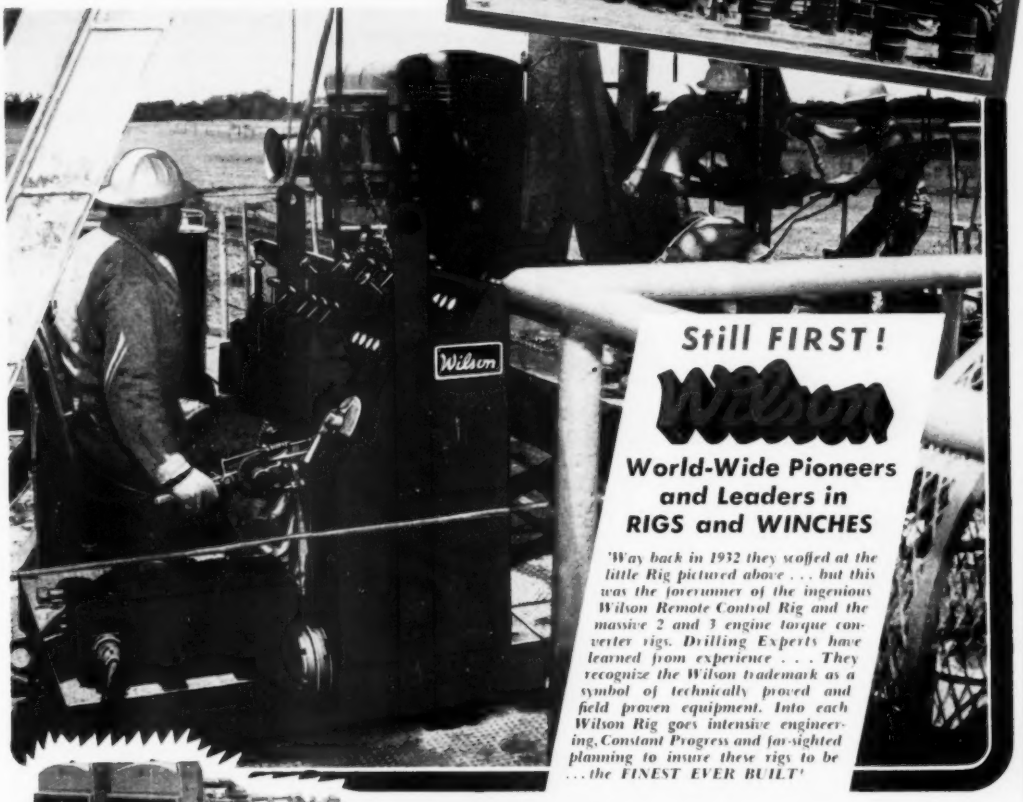

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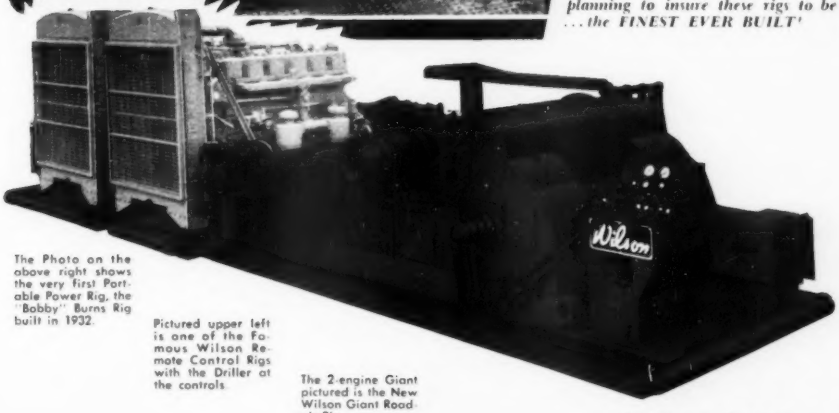

The Photo on the above right shows the very first Portable Power Rig, the "Bobby" Burns Rig built in 1932.

Pictured upper left is one of the Famous Wilson Remote Control Rigs with the Driller at the controls.

The 2-engine Giant pictured is the New Wilson Giant Roadair Rig.

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WICHITA FALLS, TEXAS

This early-day spudder is shown operating near Bartlesville, Okla. It was at Bartlesville that the first commercial oil well in the State of Oklahoma went on production in August 1903.

rig, a Smith-Vaile 5 by 8 by 10-in. pump, a 9 by 12-in. F. & T. engine, a two-post draw works, and a 30-hp. boiler. The steam engine weighed about 2,000 lb. and cost about $250. The draw works weighed about 5,000 lb. and cost $250, and the slush pump weighed 2,000 lb. and cost $235. The traveling block had 16-in. sheaves, weighed 300 lb., and cost $115.

Heavier and heavier steam rotary equipment has been the trend through the years. By the early 1920's, when wells were seldom more than 5,000 ft. deep, rotary rigs were powered with steam equipment designed for 150 to 200 psi. working pressure. Three 65 or 85-hp. boilers were generally sufficient to meet all power requirements with considerable reserve capacity.

A heavy-duty steam rig of the present period dwarfs the 1901 rig. For example, a steam rig used by Magnolia Petroleum Co. for drilling 10,000 to 15,000-ft. holes in South Louisiana has 600 hp. available—20 times that of the Spindletop rig. The equipment of this rig includes four 150-hp. standard oil-field fire-tube boilers, three 20-in. mud pumps, a 14 by 14-in. draw-works engine, and a 12 by 12-in. rotary engine.

Trend Towards Power Rigs

ONE of the earliest applications of internal-combustion engines to drilling was the portable cable-tool machine. An important factor in this early use of internal-combustion engines was the development of high-compression, high-speed industrial engines. The early internal-combustion engines were too large and operated at too slow speeds for oil-field use.

The earliest mechanical rigs lacked flexibility and ease of operation. This was primarily due to the fact that the draw works, or hoist, used with the engines was designed for use with steam engines. These hoists had either three (two-shaft) or four (three-shaft) speeds, and all clutches were made from steel castings and were either square or jaw type. It was necessary to install a reversible clutch between the draw works and the engines to absorb the shock of hoisting and to provide a means of releasing the clutches in case the driller was unable to bounce them out with the brake.

It was not until draw works began to be specifically designed for use with internal-combustion engines that the full values in fuel economy and portability could be realized along with flexibility and ease of operation. The use of hydraulic couplings and torque converters, in recent years, has further boosted the use of internal-combustion engines.

It is impossible to select an exact date for the introduction of internal-combustion engines to the Southwest drilling industry. However, the middle 1920's is the approximate period. In 1926, one manufacturing firm built a mechanical rig for use as a servicing unit. By 1930, the same firm was making mechanical drilling rigs.

Steam's predominance as the source of power in rotary drilling has particularly dwindled since World War II. The trend, especially on heavy rigs, is towards the diesel engine because of its economical operating costs. Wartime expansion of diesel manufacturing made available to the industry a large selection of engines suitable for power drilling rigs. Also dual-fuel engines which will operate either on natural gas or diesel fuel have seen some use as drilling engines.

FIRST USE OF ELECTRIC MOTOR-DRIVEN ROTARY RIG

THE first use of an electric-motor-driven rotary rig in the Mid-Continent area was in Earlsboro, Oklahoma, field. In September 1927, according to Richard K. Huey, Shaffer Oil & Refining Co. installed an electric rig on its 7 Clark well. Huey, today, is vice president in charge of production for Deep Rock Oil Corp., successor company to the Shaffer firm.

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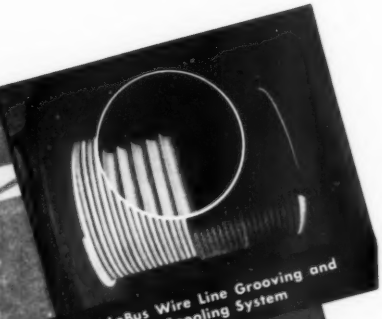

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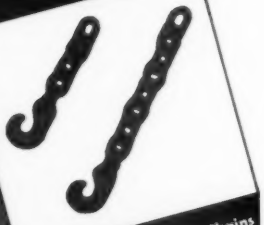

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The Lean Early 30's Accelerated Trend Toward Greater Portability

ONE of the most significant trends in Southwest drilling over the past 25 years has been the increasing emphasis on portability. This has been true with both cable-tool and rotary rigs. The lean years following the stock market crash in 1929 gave considerable impetus to the trend towards portability. The necessity of keeping costs at an absolute minimum led many operators to give serious thought to reducing rigging-up and tearing-down time by means of increased portability.

Drilling rigs in the early days consisted of numerous heavy parts, all of which were dismantled at the completion of every well and reassembled on the new location. Often, in some areas, the time spent on rigging up and tearing down was greater than is now consumed in drilling a well.

In the case of steam rigs, even the boiler manifold and other small assemblies were often taken completely apart. The draw works, or hoist, was likewise taken completely apart and reassembled. Derricks were built for the drilling of each well and were generally left standing in case the well was successfully completed.

Today, there are standardized layouts; unit skids for pumps, boilers, and shale shakers; and standard piping manifolds fitted for quick making and breaking of joints and connections. Savings up to 50 per cent have resulted from well-planned layouts and properly designed and equipped rigs.

Hu M. Harris, a Humble Oil & Refining Co. engineer, is credited by some with building the first unitized draw works. The original model was installed on a drilling rig in Conroe field of Texas in 1932.

The trend towards portability has resulted in completely portable rigs for the drilling of wells. The first portable units were core-drilling machines. Shortly thereafter, portable well-servicing units were developed. The next logical step was the manufacture of portable drilling rigs.

A portable drilling rig manufactured in the early 1930's was made by redesigning an already successful core drill. The unit was designed to drill producing wells down to 2,000 ft. It had its own 40-ft. derrick, rotary table, swivel, kelly, draw works, and power.

Jackknife derricks and telescoping masts have been a considerable factor in the development of highly portable drilling rigs. Even where the quick-erecting derricks are transported separately from the other drilling equipment, considerable time is saved.

In the past 10 years, it has become the practice in some areas to skid completely assembled large derricks from one location to another. (Terrain permitting, of course.) A variety of systems have been used to accomplish this including track units of the type used on tractors, and war-surplus bomber wheels.

Seven men well known to the drilling industry are shown in this photograph taken in 1933 in front of the discovery well of Long Lake field, Anderson County, Texas. In the picture are J. H. Gahan, assistant vice president, Tide Water Associated Oil Co., Houston; C. P. Watson, vice president, Seaboard Oil Co. of Delaware; John M. Lovejoy, president, Seaboard, New York; R. B. Pringle, vice president of Tide Water at the time and now retired in Tulsa; Ed Shea, president of Tide Water at the time and now president of Utility Holding Co.; E. H. Salrin, vice president and general manager, Tide Water, Houston; and R. S. McFarland, vice president, Seaboard.

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Vocational Training

WHEN Spindletop was discovered there were few experienced oil-field drillers; they had to be made on the job. In those days a period of service of from 4 to 6 months was often sufficient to elevate the roughneck to a driller.

Today, there are extensive training programs available designed to train workers in their every-day jobs. These programs are being sponsored by the American Petroleum Institute, the American Association of Oilwell Drilling Contractors, and the industrial training divisions of a number of universities and junior colleges.

The A.P.I. sponsored vocational training classes in drilling practices as early as 1934. Early training was essentially elementary. By contrast, present-day training is on a much higher level, illustrative of the greater need of oil-field workers for technical knowledge.

Standardization

ONE of the most significant contributions to the advancement in drilling practices has been the standardization of oil-field equipment sponsored by the A.P.I. This program was inaugurated by the Institute in 1923, just 22 years after the discovery of Spindletop.

One of the principal causes of trouble and expense at that time, was the lack of interchangeable threads and tapered joints. Before A.P.I. standardization, there were more than 200 different kinds of derricks. After standardization, there were only 15—8 steel and 7 wooden.

The late J. Edgar Pew of Sun Oil Co. was an outstanding leader in promoting standardization. He was general chairman of the A.P.I. standardization program from its beginning in 1923 until his death in 1947.

Today, A.P.I. standards are not only in general use throughout the United States, Canada, and Mexico, they are international. It is now possible to purchase the component parts of a drilling rig in 27 different countries, ship them, for example, to Timbuktu, Africa, and satisfactorily drill an oil well. A radical demonstration of international standardization is that today American oil companies are importing tubular goods from Europe, particularly England, France, and Germany, made to A.P.I. specifications, which interchange perfectly with American products.

HOW VALUES CHANGE

TIMES have changed! In 1914, drilling equipment in various fields of the Southwest was valued as follows:

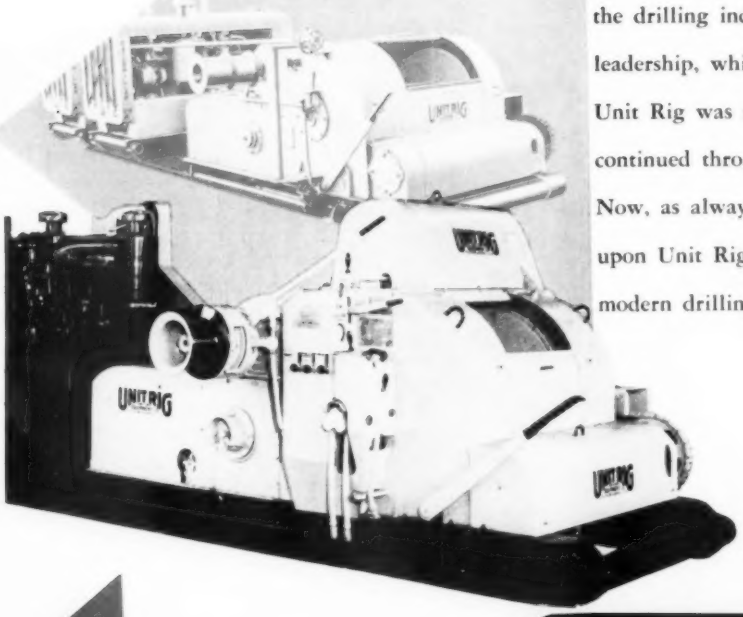
74-ft. derrick with 4½-in. rig irons used in Oklahoma	$950
82-ft. derrick with 5-in. rig and calf irons in Oklahoma	$1,250
84-ft. derrick with 6-in. chain-driven rig and calf irons in North Texas	$1,650
84-ft. Gulf Coast rotary derrick	$300
112-ft. Gulf Coast rotary derrick	$400

First production from the K.M.A. deep sand of southwestern Wichita County was discovered in 1937 at the Jack Kadane 1 C. A. Mangold. Among those shown at the discovery well are: Jack Kadane, Fred Kadane, Preston Woods, Charles Kadane, L. W. Mangold, Edward G. Kadane, L. C. Griffith, G. D. Anderson, George Kadane, and W. P. Wiest. The discovery started a new boom which rivaled the fabulous Burkburnett boom of 1918.

Fifteen Years (1936-1951)

OF SERVICE TO THE OIL INDUSTRY...

Pictured in red, is Unit Rig's first model, the U-10. Many of these drawworks are still in operation.



Unit Rig was the FIRST to introduce a unitized drawworks to the drilling industry. This leadership, which began when Unit Rig was started in 1936, has continued throughout the years. Now, as always, you can depend upon Unit Rig for the most modern drilling equipment.

Above is the new, improved Unit Rig Model U-15. This model took the place of the U-10 in 1944 and is now the leading drawworks (for its capacity) in the oil industry.

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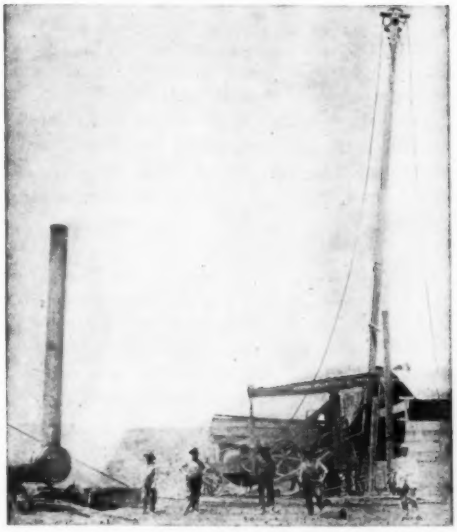

It is claimed that this steam cable-tool rig drilled the first well in the Texas Panhandle at Mobeetie, Tex., in March 1908. In picture are Virgil Graham; Frank Potts; E. J. Simpson; Cal Reuhard; and Mr. Wagner, newspaper editor.

Two of the early steel oil-field derricks were erected by W. G. Skelly and associates near El Dorado, Kans., in 1916. The more conventional wooden derricks of the time can be seen in the background.

Equipment and Materials Were Swift in Development

THE materials and equipment items used in Southwest rotary drilling are multitudinous. To report accurately the development of all equipment and material items would require volumes. High points in the development of some equipment items and materials are traced in the following paragraphs.

Wire lines.—Wire lines were being used for drilling as early as 1898 and possibly a few years earlier. It appears that wire lines were introduced into the industry first in the form of light sand lines on cable-tool rigs. It is reported that larger wire lines were first used for pulling liners and similar work where greater strength than to be had in manila lines was necessary.

Derricks.—Steel derricks were made as early as 1892, but it was not until a number of years later that they received much acceptance from Southwest operators. Most of the nation's early output of steel derricks was shipped abroad. There was a good supply of cheap lumber around most United States oil fields which accounts for the lack of acceptance of steel structures. A catalog published in 1892 gives this description of an early steel derrick:

"It is practically indestructible, made of light pieces easily transported and handled, which are fastened together with bolts; every part is made of steel; power is applied by rope running through double grooves in engine pulley, band wheel, and sand-reel head. The first rig of this kind was sent to Australia for use in a district where wood decayed rapidly."

Around 1928, steel substructures for derricks were introduced. These units eliminated the necessity for excavating cellars to contain the well-head equipment.

Diamond drilling.—It is reported that George E. Burton in 1917 suggested the use of the diamond drill for exploring for oil and gas. In 1919 one of these outfits was used at Sawyer, Okla., and drilled a hole from 2,200 ft., where it had been drilled by cable tools, to a total depth of 4,920 ft. The use of diamond coring and drilling has been stimulated in recent years by the successful use of this method in penetrating the extremely hard formations of the Rangely, Colorado, field.

Cementing.—As related by Salnikov: "Oil wells used to be completed in the first oil-producing sand penetrated by the drill. The object of cementing in early drilling operations was to place an impervious seal at the casing shoe, between the casing and the wall of the bore hole. Today, however, the procedure often is to drill through several producing horizons, set casing through all the producing sands found in such drilling, and to seal the annular space between the casing and the bore hole at a point

Today's huge trucks and related equipment offer quite a contrast to this cementing operation in Oklahoma in the 1920's. Two of the best-known names in cementing are Erle P. Halliburton and R. C. Baker. Halliburton Oil Well Cementing Co. has been the major service company in its field throughout the history of the Southwest. Baker, founder of Baker Oil Tools, Inc., is best known for the Baker casing shoe which was developed in 1907, but he has invented many other special tools for cementing and other drilling operations.

at least 500 ft. above the topmost producing zone.

"To meet these conditions, as well as other problems arising from deeper drilling, it has been necessary to improve cementing equipment and technique. During the last 10 or 15 years the industry has developed stage cementing, squeeze cementing, bulk cementing, and plastic cementing. (The application of plastics in place of cement is generally confined to workover or remedial use.) Numerous new tools, such as wall scratchers, centralizers, screens, packers, and stage and bulk cementing equipment have been invented, and better cements have come on the markt. Among the new cements now available are acid-soluble, quick-setting, slow-setting, gel-type, and high-temperature cements. The successful cementing of 7-in. casing between 19,000 and 20,000 ft. in Wyoming is indicative of the developments in equipment and techniques."

Traveling and crown blocks.—Until the early 1920's, blocks customarily had cast-iron sheaves, bronze bushings, and were lubricated by pouring oil into a cup. Around this time, pressure lubrication was introduced and roller bearings replaced the bronze bushings. Better metallurgy with the passing years has also resulted in great improvement in blocks.

Drill pipe.—Through the years improved metallurgy and advancements in tool joints have featured the development of better drill strings. The rotary tool joint was introduced around 1910, and was in fairly wide use by World War I. Heat-treated alloy-steel joints were put into use around 1919. By 1926, the A.P.I. had set up thread standards for tool joints.

In the early days, tool joints were installed in the field. By 1931, factory installation of the joints had begun. Tool joints were bucked and welded to the drill pipe as early as 1931. In later years, the shrinking of tool joints on the pipe by heat was introduced. The practice of "flash welding" came to the industry in 1938.

Rotary hose.—In 1916, a typical rotary hose had a bursting pressure of 1,000-1,500 psi. and was made of wrapped-ply water hose with a wire reinforcement around it. By 1928, it was the practice to put the wire reinforcement under the cover to keep it uniformly in place. Also, more plies were being used and better fabrics. By the 1940's, all-steel hose was in use and a number of refinements had been made in the rubber and fabric hoses. A common bursting pressure guaranteed by the manufacturers is now 5,000 psi. and some ratings are over 10,000 psi.

Blowout preventers.—At the time of World War I, a common type of preventer had a cast-iron body with ram packing elements of flexible or semiflexible material. By 1930, cylindrical ram-type preventers with rubber packing elements were in use. Preventers of today are rated as high as 5,000 psi. working pressure and 10,000 psi. test pressure.

Casing.—In the early 1900's, the quality of casing was not as good as could be desired. Frequent collapses of the pipe are recorded. Seamless casing entered the picture in the

WILD WELL SUBDUED BY DIRECTIONAL DRILLING

ONE of the earliest and most spectacular uses of controlled directional drilling in the Southwest was in Conroe field of Texas in 1933. A wild well had cratered and it was decided to drill a directional hole from a location 412 ft. away to kill it. Humble Oil & Refining Co. H-1 O. L. Alexander was started on November 26. Under the supervision of H. John Eastman, founder of Eastman Oil Well Survey Co., the well was completed on January 6, 1934, in oil sand at 5,135 ft., only 20 ft. from the vertical center line of the cratered well. Water pumped through the H-1 finally killed the wild well.

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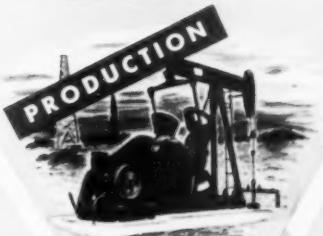

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period 1920-25, and better steel and better designed joints also improved the quality. The practice of welding casing strings was introduced as early as 1915.

Drilling mud.—The story is told that at Spindletop the Hamill brothers used a cow to stir up surface dirt with water to make drilling mud. Mechanical equipment to do this job was designed and put into use as early as 1906. As late as the 1920's most rotary wells were drilled by pumping water into the hole and letting the well make its own mud. Today, most companies employ "mud engineers" to tell its drillers how to condition the mud by using a large variety of additives such as bentonite, barite, tannic acid, carboxymethylcellulose, phosphate, starch, caustic, and other materials.

Directional-survey instruments.—The first directional-survey instrument used in the Southwest oil industry was a liquid-level inclinometer which employed an acid bottle to measure deviation from vertical. This instrument had been developed in 1873 in Dortmund, Germany, by G. Nolton.

Most of the directional surveying instruments in use today were first developed in the late 1920's and early 1930's. Four major types of instruments were put into use during that period. They are the liquid-level inclinometer using ink, the mechanical inclinometer using a plumb bob to punch a chart, magnetic single-shot instruments, and multishot surveying instruments.

Major developments in recent years consist of improvements and refinements on these four types of instruments. The acceptance of weight indicators as a standard piece of drilling equipment has reduced the number of crooked holes greatly. Most drilling contracts now specify a maximum derivation from vertical of 3°.

Many methods, techniques, and specialized tools have been developed for controlled directional drilling which was first introduced in the early 1920's. This procedure has seen use for fault control, shore-line drilling, drilling of multiple wells from artificial islands, inaccessible locations, stratigraphic traps, relief-well control of wild wells, straightening and sidetracking, and salt-dome drilling.

Air controls.—Radially operated air clutches for use in frequently engaged and disengaged rig drives; and air controls of engine throttles, clutches, and hydraulic couplings have been developed by the industry in recent years.

Bits.—Four major types of rotary drilling bits have been developed through the years—drag, rolling-cutter, disk, and "angle eccentric." Drag bits are the simplest of the four types and the one first used in rotary drilling. There are many different sizes and shapes of drag bits, but they may be generally classified as two-way, three-way, and four-way. The two-way or fishtail drag bit is the most common in the Southwest and has seen wide use in the soft formations of the Gulf Coast.

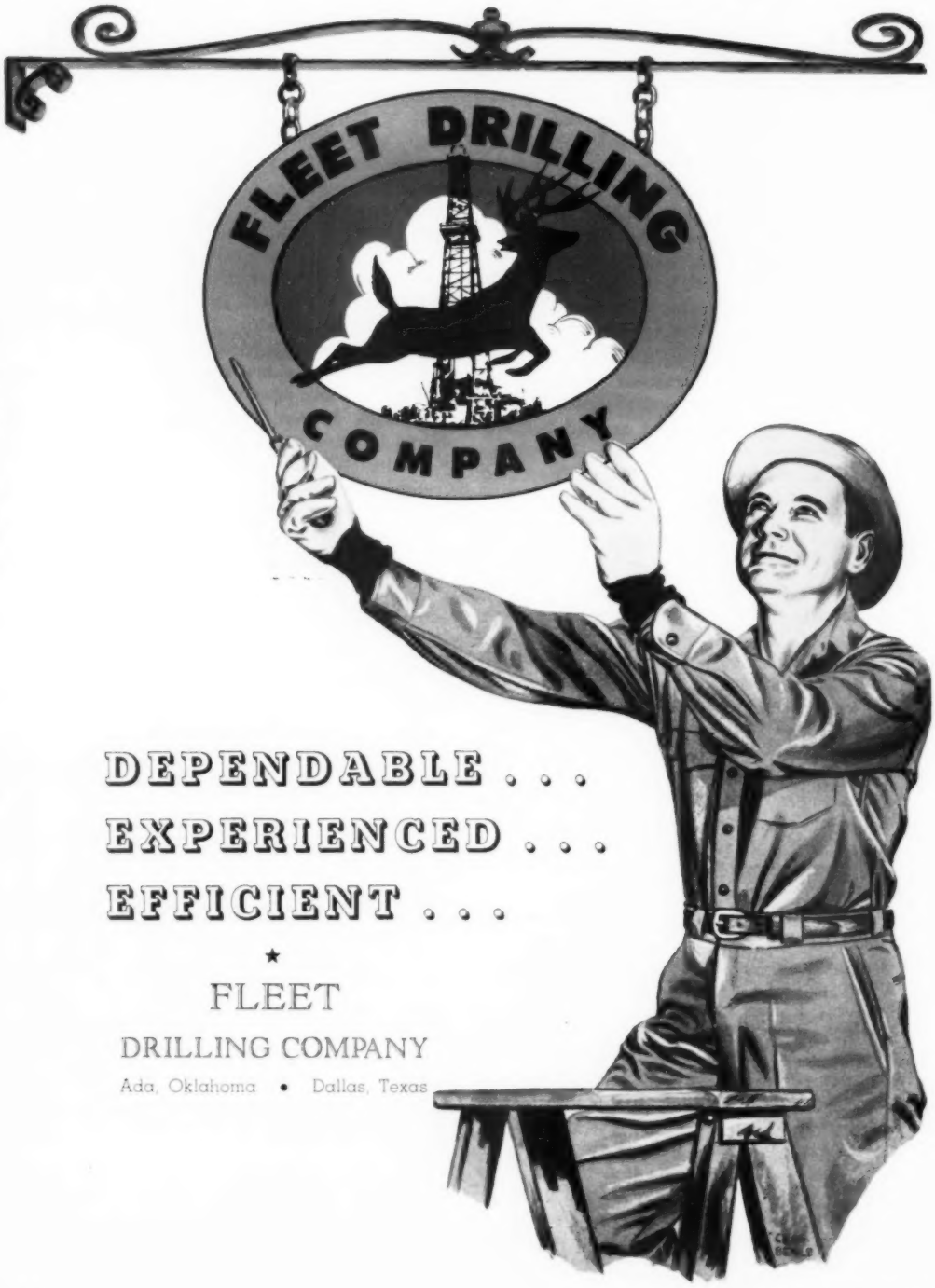
Rolling-cutter bits commonly have either cone-type cutters or cylinder-type cutters. This type bit is best known for hard-rock drilling, but rolling-cutter bits have been developed in a number of different styles to meet all kinds of drilling conditions. The rolling-cutter bit was first developed in the stone-cutting industry. Jenkins was granted a patent in 1878 for a two-cutter bit and Catlin received a later patent for a bit with two side cutters and two cross rollers.

In 1909, Howard R. Hughes, Sr., manufactured the first rolling-cutter or "rock" bit for oil-industry use. It was enthusiastically received, particularly in the Gulf Coast area. This cone-type rock bit enabled rotary drillers to dig hard rock as well as the more prevalent soft, unconsolidated formations which drag bits could handle.

One of the great difficulties with the early

The first Hughes Simplex bit, equipped with regular cones, was introduced in 1921. This photograph in the Mexia, Texas, field shows a 13¾-in. Simplex and a 9⅞-in. special disk bit used for soft formations. Shown are H. L. Blackstock (seated right), then field manager for J. E. Mabee, contractor, and himself later a widely known contractor. H. M. Hobson (extreme left) was driller.

DRILLERS TO THE INDUSTRY



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Two and one-half tons of steel were required to manufacture this 24-in. rock bit, with reamers, which was in use in the early 1920's. By contrast, today's 24-in. bit made by the same company (Reed Roller Bit Co.) weighs only 700 lb. Better metallurgy has contributed much towards reducing the weight of bits and improving their efficiency.

rotary bits was the loss of gage as the bits encountered the harder formations. This required the running of reamers. To combine the two operations in one tool, Hughes came out in 1917 with a reaming cone bit equipped with regular cones and a reamer built into the body.

Since 1917, many other refinements and improvements have been made in the Hughes bit, such as the simplex bit with regular cones in 1921, self-cleaning cones in 1925, application of tungsten carbide to the bit gage in 1928, the unit-type bit in 1931, the "Tricone" bit in 1933, special bit for extra-hard abrasive formations in 1942, and special bit for soft plastic formations in 1947.

The cross-roller type of rock bit, as contrasted with the cone-type, was introduced in 1913 in Louisiana. Reed Roller Bit Co., largest manufacturer of this type, is credited with introducing slush-lubricated rock bits. Prior to the early 1920's, bit cutters ran on oil-lubricated friction bearings. During that period, a driller unintentionally left out the plug on top of the oil lubricator of a Reed rock bit and the slush, or mud, was pumped through this opening and onto the bearing journal of the cutters. This accidental discovery led to Reed's introduction of the slush-lubricated bit. Another Reed innovation was the replacing of friction bearings with roller and ball bearings in 1932.

Disk bits, which work on the principle of the ordinary disk plow, are little used in the Southwest. The angle-eccentric bit is of the rolling-cutter type, however, it has only one cutting head and this head is set at an angle. Thus, it combines the action of a drag or disk bit with that of a rolling-cutter bit.

High-fluid-velocity (or "jet") bits are the latest development in the field of bits. Much of the initial development work was done by Humble Oil & Refining Co. This type bit employs a high-velocity mud stream which scours the bottom of the hole and removes cuttings rapidly. The major function of the mud stream, directed forward of the blade or cutters, is the disintegration and pulverization of the chips. The jet principle was first applied to drag bits, but is now being used on rock bits also.

Southwest Pioneers Marine Drilling, Both Inland and in Open Sea

THE extensive swamps, marshes, bays, and lakes of the Gulf Coast area presented new problems for the driller. A new type of rig foundation, other than the conventional land foundation, had to be developed.

A variety of approaches to the problem of marine drilling in the Southwest have been tried. These approaches, roughly in the order of their development, include: (1) Wood piling

In 1921, Walter Ramsey, Oklahoma City oil operator, offered Olson & Noble a contract to set 3,500 ft. of casing in an Oklahoma well. The drilling partnership refused to accept, feeling it was too great a hazard. Today, it is routine practice to set 14,000 ft. of casing in some fields. This 1921 picture shows A. O. Olson (right), now president of Olson Drilling Co., and Leif Olson (third from right), district manager, Olson Drilling Co.

30 *thirty years in*

ART OLSON, Founder and President
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Heavy duty rig drilling 13,000 foot well in Pegasus Field, West Texas

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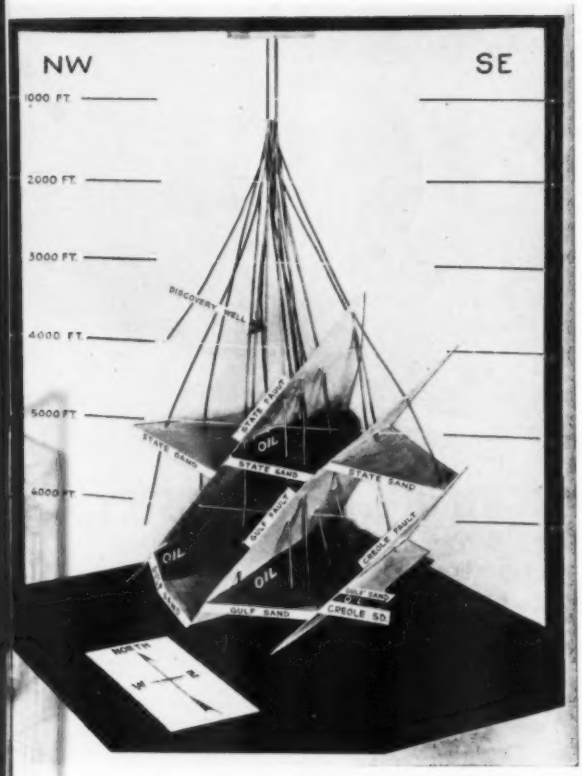

This model gives a "down-hole" conception of the 19 directional wells drilled from a single platform to exploit Creole field in the Gulf of Mexico off the coast of Louisiana. Superior Oil Co. and Pure Oil Co. discovered the field in March of 1938 for the first commercial oil discovery in gulf waters.

topped by a wood platform to support the drilling equipment. (2) Wood matting on an earthen fill (often surrounded by an earthen dike to exclude flood waters). (3) A combination of earthen island floating barge. (4) A combination of piling platform and floating barge. (5) Self-contained floating barges. (6) Submersible drilling barges. (7) Self-contained steel platforms.

First Marine Well

The nation's first overwater drilling operation was carried on by Gulf Refining Co. of Louisiana in 1911. In that year, Gulf drilled a well in Caddo Lake, which straddles the Texas-Louisiana line 15 miles northwest of Shreveport. The well was drilled from a wooden platform resting on 30-ft. cypress piling.

The equipment was crude by today's standards, but proved effective. A steam rotary rig was used to drill the well. Slush pits were 50-bbl. wooden tanks erected on piling. Blow boxes were pits into which were fitted log cribs, made just like a log cabin, one log resting on another.

A Caddo Lake well could be drilled for around $15,000. The platform and piling cost about $1,500. Lumber could be bought for $20 a thousand and it took around 12,000 ft. per well. Teaming and barging costs on the platform ran $500 and the drilling equipment $1,300.

The field of marine drilling was greatly expanded in the early 1920's. With the advent of geophysics in this period, it became comparatively easier to locate salt domes in water-submerged areas. Salt-dome discoveries before that time had resulted from either surface indications or wildcat drilling, and were thus limited.

Barge Drilling

Special steel barges on which to mount drilling equipment were developed around 1930. At first, the drilling equipment was mounted on floating barges. However, primarily because of the instability of floating barges, submersible barges came on the scene.

Preliminary plans for the oil industry's first submersible drilling barge were begun by The Texas Co. in the fall of 1931. The idea of a submersible barge had been conceived and patented by Louis Giliasso. Texaco made a contract with Giliasso for the licensing of all patent rights covering the construction of submersible drilling barges.

The first barge—the "McBride"—was placed in operation in September 1932 in Garden Island Bay field, Plaquemines Parish, Louisiana. This initial unit was built at Ingall Iron Works, Birmingham, Ala. The McBride was a twin-hull type of barge as contrasted with the single-hull slotted barge which is common today.

This new idea in drilling wells in water locations was attractive to operators for several reasons. Primarily, of course, the saving in cost of operation was appealing. It was estimated by an authority in 1946 that an approximate $15,000 savings per well is realized by the use of a submersible barge as compared with drilling from foundations constructed of piling or mats. When compared with a floating barge, the submersible barge offered several operating advantages; primarily its increased stability which left it relatively unaffected by tides, winds, waves, and changes in loading conditions.

The first submersible barge rig had all equipment on a single barge. In the ensuing

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Indian Oil Fos
Indian Fiber
Indian Cotton Seed Hulls
Indian Special Chemical
Indian Starch Preservative
Indian Red Mud
Indian Sapp
Indian Tetra Sodium Pyrophosphate
Indian Selofane Flake
Indian Soda Ash
Indian Bicarbonate Soda

One of The Texas Co., newest drilling barges, the Rhodes, is shown on location at Lake Barre field, not far from Houma, La.

years it became more common to use two barges for barge-mounted rigs—one mounting the derrick and draw works, the other the power equipment. The early barges were about 120 ft. long by 24 ft. wide. These barges were positioned about 8 ft. apart to permit drilling and the placing of the christmas tree if the well were successful. The two barges were anchored to piling and connected by a cat walk.

Recent Trends

Barge-mounted rigs continue to this day to be the most popular method for drilling marine locations. However, most of the newer units being built are one-barge units rather than two-barge units.

A 1949 development for drilling in swamps, marshes, and inland waters was the use of a steel platform and a floating barge. This system was first used in Pointe-a-la-Hache field, Plaquemines Parish, Louisiana. Jacket-type steel foundations with steel H-bearing piles support derrick, draw works, and engines. Boilers, mud pumps, pipe racks, and auxiliary equipment are mounted on a 230-ft.-long by 45-ft.-wide barge. Early experience indicated that this type installation gives results and economies comparable to the use of standard drilling barges.

The jacket-type structure was originally developed to provide a safe and stable foundation for drilling in deeper waters offshore. A large proportion of the wells in the Gulf of Mexico have been drilled from such platforms.

Offshore Drilling

It is obvious that extensive drilling offshore in the Gulf of Mexico entailed engineering problems not met in earlier marine operations. In the unprotected waters of the Gulf, wind and wave action assumed importance far beyond that in the protected waters of the swamps, lakes, and bays. In addition, the depths involved in the gulf, ranging from 15 to 100 ft. in areas of most immediate oil interest, were greater than most previously encountered. (Drilling has been done in 100 ft. of water in Lake Maracaibo.)

Much detailed engineering study was necessary before work could be started. Such heretofore foreign subjects as weather forecasting, radar, LST's, wave action, tides, marine design, and oceanography became of interest to oil men. As a result of study and experimental work, several schemes were evolved for drilling in the Gulf of Mexico.

For the first well in the open waters of the Gulf of Mexico, the tested system of drilling from wooden piling was utilized. This pioneering venture in the open waters of the gulf started October 6, 1937, in a joint operation of Superior Oil Co. and Pure Oil Co. Location was 6,000 ft. offshore from Creole, La., in 14 ft. of water. This well was completed March 11, 1938, as the first commercial oil discovery in Gulf of Mexico waters and is known as Creole field. In 1941, Superior and Pure built a second outpost drilling structure at Creole.

The discovery well was drilled from two wooden-piling structures. One contained the derrick, draw works, draw-works motors (electric), and rotary. The power plant, mud pumps, mud pits, fuel tanks, and all other accessory units of the rig were set up on the second piling structure. By means of directional drilling, the operators were successful in exploring and proving up an area nearly a mile square from the single, centrally located drilling location.

Tender-Platform Popular

Currently, the most widely used drilling method in the Gulf of Mexico is that of the floating tender-platform combination. With this system, a piling platform contains the derrick, engine, and draw works, while the remainder of the equipment and supplies necessary for drilling a well are on the floating tender which is tied up to the platform. The second most popular method to date has been to construct a large piling platform upon which all equipment and supplies for drilling a well are located. By May 1, 1949, oil companies had

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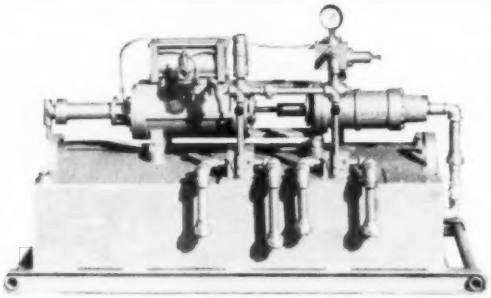

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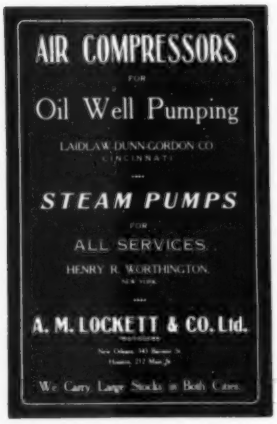

Reproduced, in reduced size, is a Lockett ad that appeared in the February 3, 1906, issue of Oil Investors' Journal.

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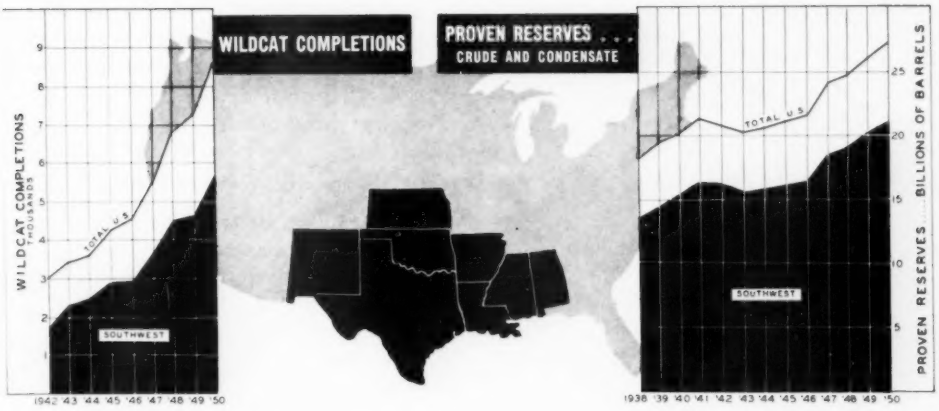
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erected 10 large self-sufficient drilling platforms and 25 smaller platforms for use with tenders.

Pure Oil Co. utilizes a floating tender-platform combination differing somewhat from the more standard method. The floating tender, for Pure operations, serves as a construction barge and for crew quarters. It is not utilized for mud storage, logging equipment, etc., as is more conventional.

Barnsdall Oil Co., Seaboard Oil Co., and Callery & Hurt (with Barnsdall as designer and operator) put on location in the post-World War II Gulf of Mexico drilling "boom" a new and radically different type of structure—a "stabilized sea drill." The drilling equipment is supported by what might be described as a floating-pile foundation. The piles are attached at their base to a large barge which, when flooded, causes the entire structure to sink to the ocean floor. Stability during flooding is provided by two large adjustable "outrigger" pontoons on each side of the structure. The structure weighs 1,120 tons and is designed for drilling to 16,000 ft.

Shell Oil Co. drilled a well off Louisiana in 1949 using a submersible barge such as had been used for swamp and inland water drilling for 15 years previously. This was accomplished by sinking war-surplus landing craft as breakwaters and providing a shell fill for the barge to rest upon.

Drilling Comparisons for the Southwest

EARLY RECORDS

OKLAHOMA: J. W. C. Bland and Fred S. Clinton opened Red Fork field at 534 ft. on June 25, 1901.

LOUISIANA: The Jennings Oil Co. 1 Jennings opened the Jennings field at 1,800 ft. on September 21, 1901.

TEXAS: Captain Lucas brought in Spindletop field from 1,160 ft. on January 10, 1901.

NEW MEXICO: Aztec-Bloomfield field discovered in 1920 with pay at 450 ft.

KANSAS: Dexter field discovered in 1903 with pay at 2,750 ft.

ARKANSAS: El Dorado field brought in in 1921 with pay at 2,170 ft.

MISSISSIPPI: Amory Petroleum Co. 1 Carter opened Amory gas field on October 6, 1926, with a 2,412-ft. well.

MARCH 1951 RECORDS

OKLAHOMA: Superior 51-11 Weller, 11-8n-12w, Caddo County, dry, TD 17,823 ft., completed in Pennsylvanian in 1947.

TEXAS: Phillips 3 Schoeps, Millican Salt Dome, Brazos County, dry, TD 16,655 ft., completed in Cretaceous in 1945.

LOUISIANA: Placid 1 City of New Orleans, 22-23s-22e, Lafourche Parish, dry, TD 16,237 ft., completed in 1950.

MISSISSIPPI: George Vasen 1 Fee, 9-2s-11w, Stone County, still coring and drilling at 20,300 ft.

NEW MEXICO: Humble 1 Federal-Wiggs, 31-24s-27e, Eddy County, dry, TD 14,865 ft., completed in Ellenburger in 1950.

ARKANSAS: Stanolind 1 Bodcaw, 29-19s-23w, Lafayette County, dry, TD 11,434 ft., completed in Smackover in 1948.

KANSAS: Stanolind 1 Feathers, 15-35s-33w, Seward County, gas well, TD 8,243 ft., completed in crystalline in the year 1947.

SOUTHWEST Drilling PERSONALITIES

The men mentioned here are among those who have devoted all or a large part of their business careers to the drilling branch of the petroleum industry in the Southwest.

Dorris Ballew, president of Dorris Ballew, Inc., Natchez, Miss., started in the drilling business as a roughneck in Oklahoma fields. He served as drilling superintendent for Phillips Petroleum Co. before organizing his own company in 1945, and now has rigs operating in several states.

A. M. Barbour, president of Barbour Drilling Co., Tulsa, first entered the oil business in 1917 with the old Gypsy Oil Co. at Tulsa. He continued with the firm until 1921, when he went into business for himself, becoming a partner in Corbett & Barbour Drilling Co., now known as Barbour Drilling Co.

Paul F. Barnhart, formerly associated with **Frank** and **George Frankel,** Houston independent oil producers, is president of B.B.M. Drilling Co., Houston, which was formed in 1950. Prior to being with the Frankels, Barnhart was with the former Barnsdall Oil Co. until 1942.

J. W. Bates, Jr., president of Reading & Bates, Inc., Tulsa, worked for his father's firm of Bates & Reading as a roustabout after graduating from Dartmouth College. Working up to driller, he resigned the firm in 1946 to form B. & B. Drilling Co. The firm's name became Reading & Bates, Inc., in 1949.

J. E. Brantly, president of Drilling & Exploration Co., Inc., Abilene, Tex., helped form Hill & Brantly in 1918. In 1921 he worked in Mexico for the old Marland Oil Co., and later for Sun Oil Co. He organized Drilling & Exploration in 1929 after serving as chief geologist for Atlantic Refining Co.,

Al Buchanan started as a roughneck at Petrolia, Tex., in 1908. In 1919 he entered into contracting with **Hal Hughes** in Burkburnett, Tex., and in 1923 organized the Al Buchanan Drilling Co., with headquarters in San Antonio.

L. D. Cain organized L. D. Cain Drilling Co. in Houston in September 1941. Prior to forming the company, Cain had been sales manager in Houston for Portable Rig Co. for about 12 years.

C. F. Camp, Tulsa, started in business with Keystone Lubricating Co., but soon established his own company. He also was secretary-treasurer of Arrow Drilling Co. (Died 1938).

W. C. Churchill, president of Arrow Drilling Co., Dallas, is a native of Nova Scotia. He joined Roxana Petroleum Corp., working up to assistant general superintendent. He formed his own company in 1931, and, starting with 1 rig, now has 22. In 1949-50 he served as president of the American Association of Oilwell Drilling Contractors.

W. P. Clements, Jr., is general manager of Southeastern Drilling Co., Dallas. The firm is owned and operated by Clements, **I. P. LaRue,** and **I. P. LaRue, Jr.,** the partnership being formed in 1947.

C. M. Copeland aided in organization of Williams-Copeland, Inc., Tulsa, in September 1942. He formerly had spent 15 years with a major producing company and 7 years with a drilling firm. **O. D. Williams** and **Ralph Gwilliam** were other organizers of the company.

Sam Cook, president of Cook Drilling Co., Fort Worth, served as a roughneck, roustabout, tool pusher, and production superintendent before developing his own company. His firm now has about 50 producing wells in Texas, Louisiana, and Mississippi.

G. B. Cree, organizer and manager of G. B. Cree and Asscciates, Pampa, Tex., started in the drilling business as a tool dresser and later became a driller. He established his own firm in 1925, and started producing in the Texas Panhandle in 1927. His rigs are now operating in the Panhandle, West Central Texas, and in the San Juan basin of New Mexico.

C. J. Creekmore, president of Creekmore Drilling Co., Tulsa, worked as a roustabout for the old Prairie Oil & Gas Co., and dressed tools for various drilling contractors during summers while attending college. In 1927 he bought an interest in his father's firm, Creekmore Drilling Co., and became president after his father's death in 1944.

R. H. Crow, president and organizer of Crow Drilling Co., Inc., Shreveport, was formerly drilling superintendent for Haynes Drilling Co., Shreveport. He has pioneered in use of jackknife-type derricks, and has built several of his own design.

A. L. Derby, Wichita independent operator and drilling contractor, was formerly president of Derby Oil & Refining Co., Wichita, which he founded.

A. R. Dillard, president of Dillard-Waltermire, Inc., Wichita Falls, Tex., entered the oil industry in 1905 with Humble Oil & Refining Co. at Corsicana, Tex. He organized the present drilling firm in 1916.

William E. Finefield was a pioneer cable-tool driller in Kansas and Oklahoma. He entered the oil industry with Prairie Oil & Gas Co. at Chanute, Kans., in 1899, and later joined Wiser Oil Co. at Chelsea, Okla. (Died 1948).

Charles W. Flint headed several oil-field equipment-manufacturing companies. He was president and owner of Tulsa Rig, Reel & Manufacturing Co., American Steel Derrick Co., and Mud Products Co., all of Tulsa. (Died 1950).

W. W. Fondren, who figured in the founding of Humble Oil & Refining Co., Houston, began working as a roughneck in Corsicana field, Texas, in 1895. Later he began operations of his own at Beaumont, Tex., and other coastal fields and was well known as a drilling contractor. (Died 1938).

C. C. Forbes, president of Noble Drilling Corp., Tulsa, first entered the oil industry as a bookkeeper for a contract-drilling firm. In 1928 he joined Noble-Olson Drilling Co., and when the partnership was dissolved in 1930 the firm became Noble Drilling Co., with Forbes as treasurer. He later became executive vice president, and was named president in 1948 after the retirement of the late Lloyd Noble.

January 18, 1907 OIL INVESTOR'S JOURNAL

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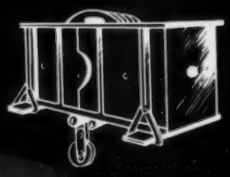

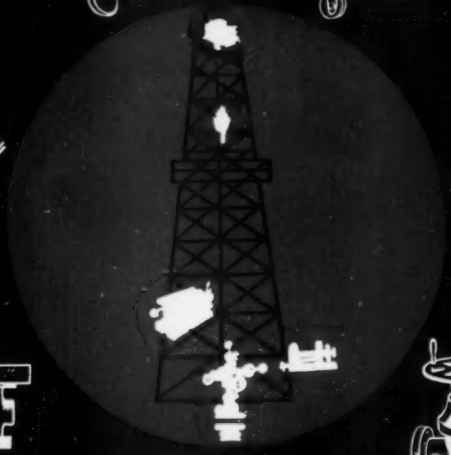

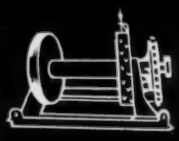

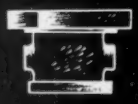

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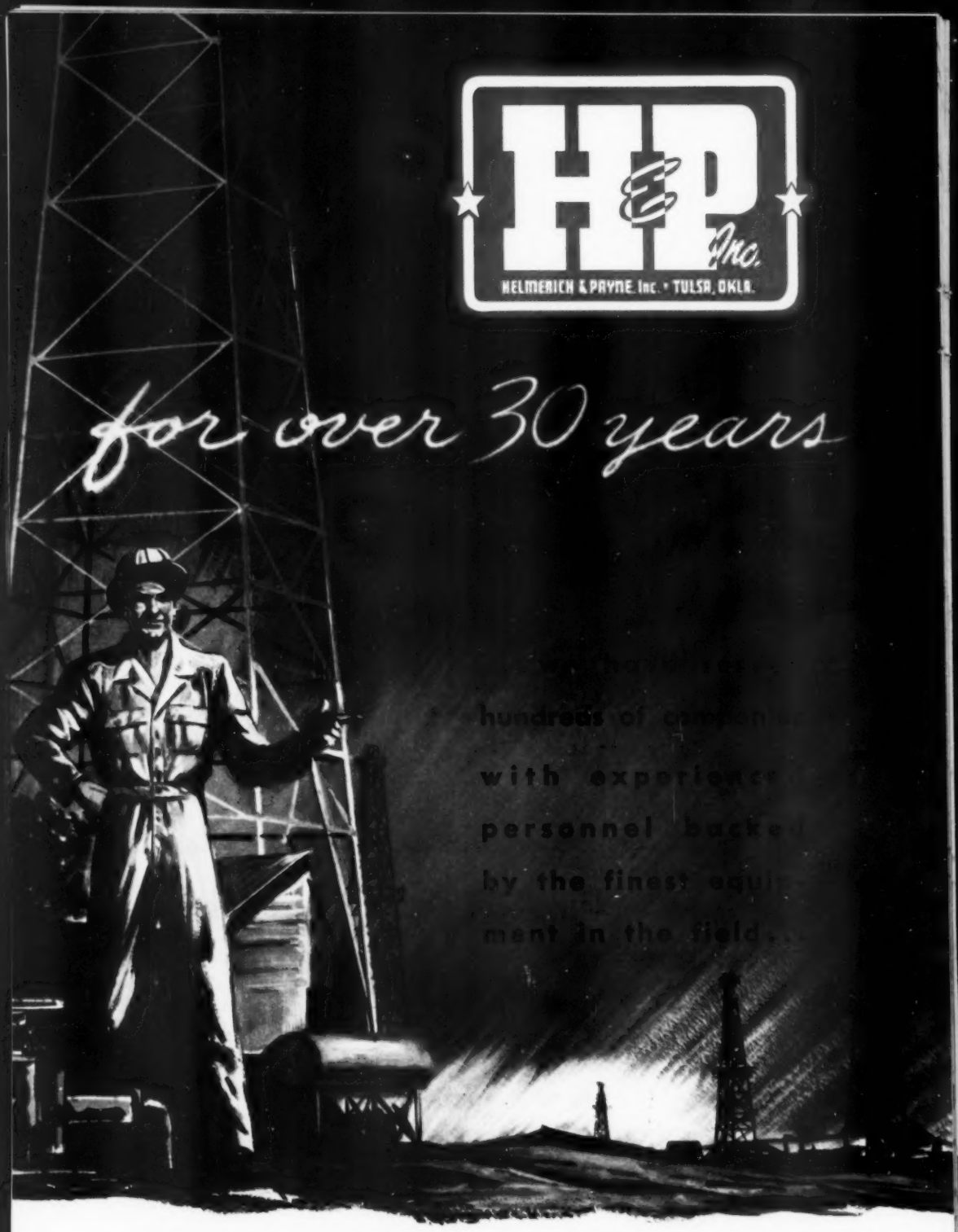

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R. J. Fryer, president of Standard-Fryer Drilling Co., started his oil-field experience in Oklahoma areas in 1920. Headquarters of the firm is in Dallas.

J. Macon Gardner, vice president of Gardner Brothers Drilling Co., Dallas, began his career in the oil business as a drilling hand for Gulf Refining Co. in 1928. He joined Gardner Brothers in 1936 and was named tool pusher in 1938. In 1943 he became the firm's drilling superintendent until 1946, when he became vice president.

C. C. Gilger, managing partner in Gilger Drilling Co., Houston, started in the drilling business in Oklahoma, but moved to Texas in 1930. His firm was organized in 1941.

C. G. Glasscock, Sr., part owner of C. G. Glasscock Drilling Co., Corpus Christi, Tex., has been a drilling contractor since 1925. He started in the oil business as a rig builder at Burkburnett, Tex., in 1919. With his brother, **Lonnie Glasscock,** he is an active independent oil producer and operator.

Roy Guffey, graduate petroleum engineer from University of Oklahoma, is general manager of Roy Guffey Drilling Co., Dallas, which was organized in 1939. He formerly was associated as a partner in a derrick-manufacturing and engineering company in Oklahoma City.

W. H. Helmerich is president of Helmerich & Payne, Inc., and also an independent oil operator. Helmerich & Payne was incorporated in 1926, and is headquartered in Tulsa.

Seth W. Herndon, president of Herndon Drilling Co., Tulsa, joined Bu-Vi-Bar Petroleum Corp. in Tulsa in 1919. When it was sold in 1930 he became an independent oil operator, and later formed the present firm. He attended University of Missouri.

C. N. Housh, partner in the firm of Housh Drilling Co., Houston, began in the oil business with Gulf Oil Corp. as a geologist. Leaving Gulf in 1936, he became an independent operator. The firm was then known as Housh-Schoefield & Thompson.

Sherman Hunt, Jr., president of Empire Drilling Co., Dallas, worked in all phases of drilling and land departments before serving overseas in the U. S. Engineers Corps. Returning to the United States, he organized Empire Drilling with his brother, **Stuart Hunt.** He is also partner in Headwaters Oil Co., Dallas.

A. F. Keating, president of Keating Drilling Co., Tulsa, joined the firm 11 years ago when it was Robay Drilling Co. In 1943 the firm began operating under its present name. All rigs are rotaries.

Joe T. King entered the drilling-contracting business in Okmulgee, Okla., in 1908. In 1914 he joined with **W. E. Wood** to form Kingwood Oil Co., which drilled 600 wells in Oklahoma and Texas. Headquarters for the firm were moved to Effingham, Ill., in 1937. (Died 1940).

H. W. Klein organized Big West Drilling Co., Dallas, with **Grady Vaughn, Sr.,** in 1936. He previously was with Stanolind Oil & Gas Co., Tulsa, as general superintendent.

Theodore N. Law, president of Falcon Seaboard Drilling Co., Tulsa, is a great-grandson of the late William Barnsdall. Law has been actively engaged in the oil business for more than 20 years.

Tom S. Loffland, formerly in the partnership of Loffland Brothers, Tulsa, came to the Mid-Continent area from Woodville, Ohio, at the end of World War I, and formed a partnership with **Jack M. Loffland** in 1927. In 1946 stockholders disposed of their holdings, with Tom Loffland in position of chairman of the board.

J. E. Mabee, Midland, Tex., president of Mabee Petroleum Corp., has been in the oil business since 1910 when he started as an independent lease owner at Walters, Okla. For the past 40 years he has operated as an independent operator and driller in Texas, Oklahoma, Kansas, and Illinois. He organized Mabee Petroleum Corp. in September 1947.

Fred McConnell, president of Lee Drilling Co., Tulsa, started his oil career with Bridgeport Machine Co. in Wichita in 1926. He left the firm in 1936 to join Lee Drilling as general manager. He was named president in 1940.

Alex McCutchin organized McCutchin Drilling Co., Dallas, in 1931, and was widely known for his drilling operations in Louisiana, Oklahoma, and Texas. The firm is now managed by his widow. (Died 1949).

R. M. McDannald is coowner and managing partner of Mac Drilling Co., Houston. He was graduated from University of Oklahoma in 1937, and helped organize Mac Drilling in July 1941.

Dean A. McGee, executive vice president of Kerr-McGee Oil Industries, Inc., Oklahoma City, spent 10 years with Phillips Petroleum Co. before joining Kerlyn Oil Co., Oklahoma City, in 1937 as chief geologist. In January 1946 the firm became known as Kerr-McGee.

C. R. McVay, partner and manager of McVay & Stafford Drilling Co., Tulsa, joined Frick-Reid Supply Co. in 1925, and remained with the firm until 1935. He joined Parker Drilling Co. at that time, and 10 years later formed the present firm.

Solomon R. Mealy was the senior member of Mealy-Wolfe Drilling Co. He became active in the oil industry in 1913 when he aided in organizing Rogers County Drilling Co. (Died 1948).

John W. Mecom, Houston independent producer and driller, is credited with opening Rose City field in Orange County, Texas, reopening Greens Lake field, Galveston County, Texas, and extending North Hull field's flank. He has five rigs drilling.

Byron Meredith, Houston, was with Sinclair Prairie Oil Co. and its predecessors from 1918-46. In November 1946 the firm of Meredith, Clegg & Hunt was formed, with Meredith as president.

Edward F. Moran headed E. F. Moran, Inc., Tulsa drilling-contracting firm. Prior to forming his own organization he had been associated with Cosden Oil Corp. and The Texas Co. (Died 1948).

Joseph S. Morris, partner and general manager of Allen & Morris, San Antonio, has been with the firm since 1923. Operations of the company, of which the late W. W. Allen was a partner, have covered Southwest Texas and Gulf Coast areas, extending as far as the Dominican Republic.

J. F. Murphy was a veteran drilling contractor from Sapulpa, Okla., and drilled in Cleveland pool, Pawnee County, and Glenn pool, Tulsa County, Oklahoma. He was superintendent in the early days of Skelly Oil Co. (Died 1936).

E. J. Nicklos, leaving Mexico in 1921, became division manager for The Texas Co. in Oklahoma in

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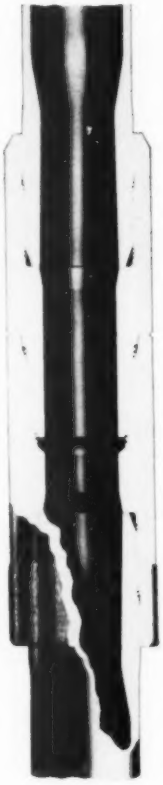

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267A

1923. Six years later he left Texaco to become production vice president for Continental Oil Co., holding that position until 1935 when he organized the firm of Nicklos Drilling Co. in Houston.

Lloyd Noble founded Noble Drilling Co. in 1930. He was also chairman of the board and president of Samedan Oil Co., Ardmore, Okla.; Old Ocean Oil Co., and J. S. Abercrombie Co. His colorful career as an oil man began in 1921 when he formed a partnership for drilling and contracting. (Died 1950).

Arthur O. Olson, president of Olson Drilling Co., Tulsa, entered the oil business in 1917 as a roughneck in Wyoming. In 1919 he joined Rocky Mountain Drilling Co. as a driller. A year later he formed a partnership with **Art Simpson.** Later, after this firm was dissolved, with the late Lloyd Noble he organized Noble-Olson Drilling Co. This company likewise was dissolved, and in 1930, with **H. S. Diem** and **H. C. Bundy,** Olson formed Olson Drilling.

C. J. Paine became a partner in F. B. Paine Drilling Co., Dallas, in 1928. He was one of the early advocates of FM-radio hookup between drilling rigs.

Gifford C. Parker organized Parker Drilling Co., Tulsa, in 1934, now one of the Southwest's largest drilling operations. Parker previously was associated with the former Campbell & Parker Drilling Co.

William T. Payne, president of Big Chief Drilling Co., Oklahoma City, and a past president of the American Association of Oilwell Drilling Contractors, was a chemist before going into the drilling business. Serving as a scout for North American Oil & Refining Co. in Oklahoma, he organized Big Chief Drilling in 1936.

W. G. Prince, head of Prince Drilling Co., Inc., Houston, is a veteran drilling and production man in the Gulf Coast area. He was associated with **W. R. Davis** from 1937-41.

Chester L. Roberts, president of B. & R. Drilling Co., Russell, Kans., formerly worked for Twin Drilling Co. for 13 years. The firm was formed in 1941.

A. H. Rowan, chairman of the board of Rowan Drilling Co., Inc., Fort Worth, formerly was with Humble Oil & Refining Co. In 1923, with his brother, **Charlie L. Rowan,** he organized Rowan Drilling Co.

R. L. Rush, president of Trinity Drilling Co., Dallas, formerly worked with Sinclair Oil & Gas Co. at Ranger, Tex., and was farm boss for Simms Oil Co. in West Texas.

W. C. Schoenfeld, head of Schoenfeld-Hunter-Kitch Drilling Co., Tulsa, organized the partnership firm. He is a native of Pennsylvania, and moved to Oklahoma in 1912.

J. R. Sharp, president of Sharp Drilling Co., Tulsa, entered the oil industry in 1926 with Oklahoma Iron Work Supply Co. He left the firm as vice president in 1934 to organize Sharp Drilling.

H. L. Singletary, partner in Iron Drilling Co., Tulsa, started his career in the oil business in 1929 with old Indian Territory Illuminating Oil Co. He left in 1930, returning to Oklahoma City University to complete his education. He joined **Slick Urschel,** independent, in 1932, and in 1936 formed the present partnership with **H. Babcock.**

T. B. Slick was one of the most spectacular wildcatters and at one time the largest individual oil producer in the Southwest. He first was a teamster and then a lease buyer in Cushing field of Oklahoma. (Deceased).

E. A. Smith, president of Service Drilling Co., Tulsa, joined Roxana Petroleum Corp. in 1915, later resigning to join Humphrey Corp. In 1922 he became an independent operator, and retained this position until 1947 when he organized the drilling firm.

George L. Streeby, operating head of Lynn Drilling Co., Tulsa, was associated for many years with Lewis Oil Corp. He organized the drilling company after the Lewis company merged with The Texas Co.

H. L. Sullivan, president of Zephyr Corp., Tulsa, moved to Tulsa in 1916 and helped to organize Loffland Brothers Corp. He resigned as president of Loffland in 1947 and in 1948 organized Zephyr Corp.

Jay Taylor, president of Baker & Taylor Drilling Co., Yucca Drilling Co., and Isthmus Development Co., Amarillo, started his oil-field career at Duncan, Okla., as a tool dresser. He later served as driller. He organized his own companies in 1947 and 1950.

A. R. Thomas, veteran drilling contractor from Tulsa, moved to Oklahoma in 1907 and became field superintendent for Stubbs & Lowe. He later helped organize Commercial Drilling Co. and Rogers County Drilling Co. (Died 1940).

A. W. Thompson has been active in the oil industry since 1919. He is president and general manager of Thompson-Carr, Inc., Houston, which was organized in 1924 to engage in drilling-contracting work. The firm was first known as Mohawk Drilling Co.

B. A. Wales, secretary-treasurer and general manager of J. & C. Drilling Co., Refugio, Tex., left a banking career in his home town of Florence, Tex., for experience in oil-field machine shops. He started with J. & C. as a bookkeeper.

J. E. Warren, president of Carl B. King Drilling Co., Midland, Tex., joined the firm in 1934. He is president of the Independent Petroleum Association of America, and a past president of the American Association of Oilwell Drilling Contractors.

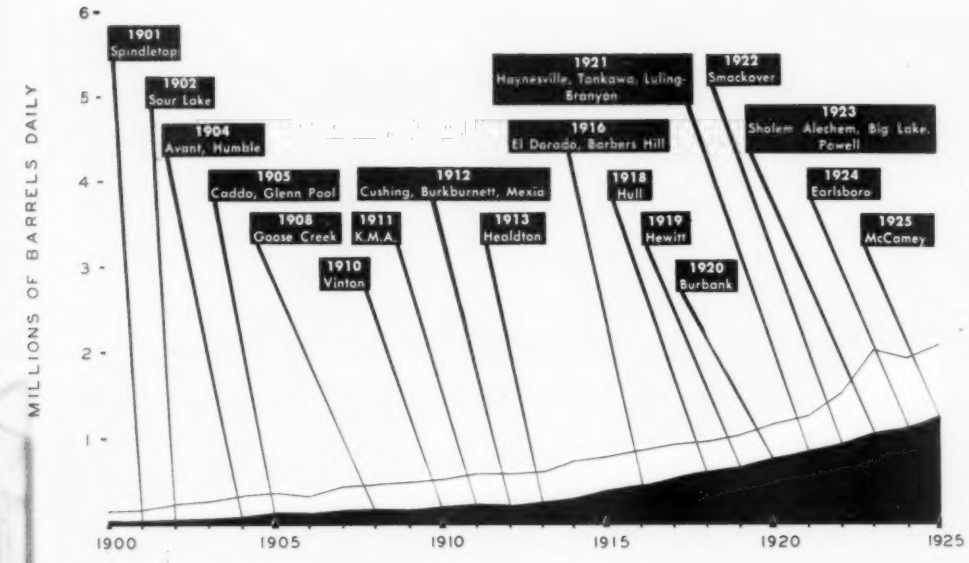
C. B. Webster is a partner in Hinkle Drilling Co., Houston. A driller with Nicklos Drilling Co. prior to joining Hinkle in 1944, he formerly worked for a number of other contracting firms.

N. H. Wheless is president of Wheless Drilling Co., Shreveport. The firm was organized in 1923 as Sultana Drilling Co., and was changed to its present name in 1936.

R. W. Wire, president of Loffland Brothers, Tulsa, joined National Tube Co. in 1922, and joined Loffland in 1948 as president. Wire is a native of Ohio.

R. J. Wolfe began his career in the contracting business at Electra, Tex., in 1919, with a small drilling rig and spudder. In 1934 he formed Grey Wolf Drilling Co., a partnership with **William D. Gray** of Tulsa.

Joe Zeppa, president of Delta Drilling Co., Tyler, Tex., one of the large drilling firms of the Southwest, was active in the organization of East Texas Salt Water Disposal Co. and is a director of this firm. Delta Drilling was incorporated in 1931, beginning with two small used steam-rotary rigs.



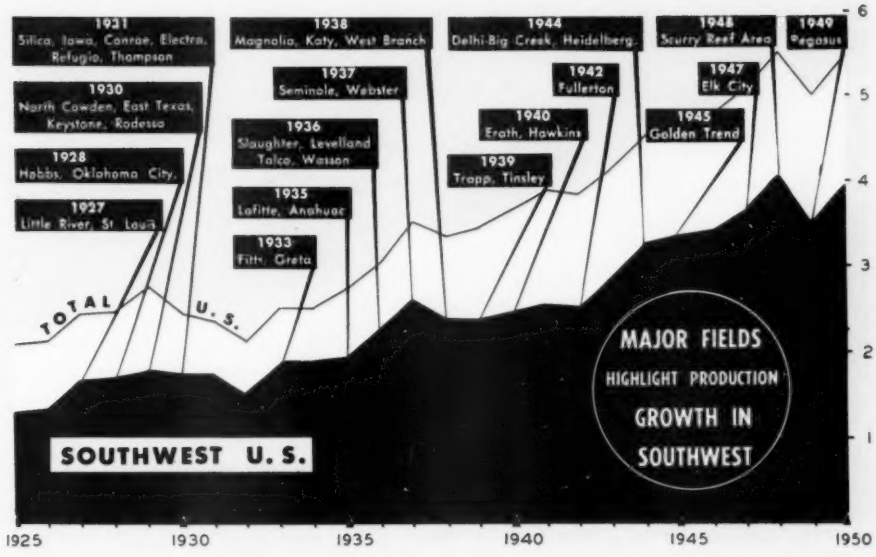
Southwest Quickly Dominated

Spindletop to World War 1

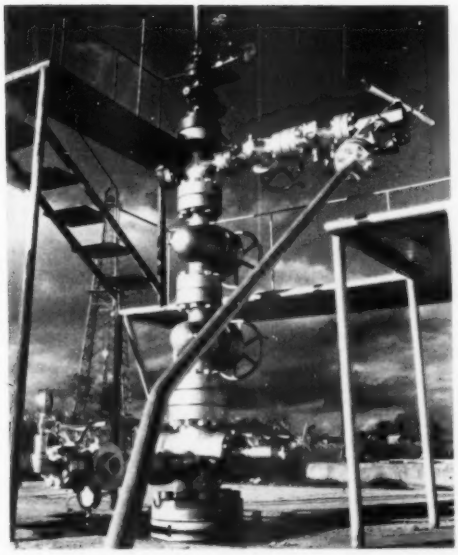
CAPTAIN LUCAS' unprecedented gusher at Spindletop, Tex., near Beaumont, ushered in a frantic period of exploration along the Texas Gulf Coast. Some fields were discovered —Saratoga and Sour Lake in 1902, Batson in 1903, and Humble in 1905—but the over-all results were disappointing. The year 1905 marked the peak period of production for Texas in the early days of the century. By 1910 production had dropped to one-third of the 1905 peak. Most Texas fields followed the pattern of Spindletop—they were opened with a rash of gushers which rapidly depleted the reservoir pressure and caused the fields to decline rapidly. W. L. Mellon, one of the founders of Gulf Oil Corp., said during this period, that "Texas oil is such a headache."

A group of Jennings, La., businessmen,

The discovery of oil at Glenn pool, a few miles south of Tulsa, in 1905 took the oil spotlight off Texas. The famous field produced as high as 120,000 bbl. daily during its flush period.



Nation's Petroleum Supply



A large number of high-test valves are required on christmas trees in high-pressure oil fields of the Gulf Coast area. This picture was taken on a lease in Chocolate Bayou field, Brazoria County.

by Leigh S. McCaslin, Jr.

prompted by the conviction of Tom Mahaffey that there was oil to be found at a gas-emitting spring in the area, secured Louisiana's first oil leases. Jennings Oil Co. was formed and W. Scott Heywood, a successful Spindletop operator, was hired to drill a well. On September 21, 1901, oil came spouting 25 ft. above the derrick from pay sand at 1,800 ft. and opened Louisiana's first major oil field, and also its first salt-dome production.

The first commercial oil well for the state of Oklahoma (then Indian Territory) went on production in August 1903, although it had been drilled 6 years earlier. This historic producer—Cudahy Oil Co. 1 Nellie Johnstone—is located in Bartlesville-Dewey field on the south bank of the Caney River in Bartlesville. The well was completed in April 1897, under the supervision of John F. Overfield, but was shut in for lack of storage and transportation facilities. After that, protests from Cherokee tribesmen and allotment formalities kept the well

View of Corsicana field when Spindletop discovery was made. This was the only field of any consequence in Texas and the largest in the entire Southwest previous to 1901.

shut in until 1903. Other early Oklahoma production was found at Muskogee and Chelsea, but was not large. Sizable booms developed with the discovery of oil at Red Fork in 1901 and Cleveland in 1904, but neither was a major field.

Glenn Pool Breaks Price

It was in 1905 that Oklahoma took the oil spotlight off Texas with the discovery of Glenn pool, a few miles south of Tulsa. The first well at Glenn pool was brought in November 22, 1905. However, Bob Galbraith and Frank Chesley, the independents who brought it in, maintained such secrecy that its significance was not recognized until well into the following year. It was not until September 1906 that a major company sent its scouts into Indian Territory.

Glenn pool produced as high as 120,000 bbl. a day during the boom and had the largest flush production in the United States up to that time. By 1906 Oklahoma was the leading crude producer in the Southwest—a supremacy which the state maintained until 1928 when Texas overtook it. By 1907 the flood of oil from the field caused a break in posted crude-oil prices.

In Louisiana the outstanding field of the first decade of the century was Caddo in the northern part of the state. First oil was discovered in the field in 1904, but the well was aban-

This "gag shot" of J. Edgar Pew (seated) was taken in the early 1920's during an A.P.I. meeting in the Southwest.

J. EDGAR PEW

ONE of the greatest names in production practices and techniques in the southwestern oil industry is that of James Edgar Pew.

Pew was born in Mercer, Pa., in 1870, and died November 22, 1946, in Philadelphia, after 60 years of devoted service to the petroleum industry. He began his career at the age of 16, as a plumber's helper with Peoples Natural Gas Co., in Pittsburgh.

In 1896 Pew joined Sun Oil Co. at its Toledo refinery, and in 1901 was sent to Beaumont, during the Spindletop boom. Early in 1913 he resigned to become an independent oil producer, and late that year joined Carter Oil Co., in Tulsa, as vice president and western manager. In 1919 he rejoined Sun as vice president in charge of production and pipe-line operations, a post he held until his death.

One of the founders and the second president of the American Petroleum Institute, Pew was best known for his work in connection with the adoption and execution by the Institute of a program for the standardization of oil-field equipment. He was always in the forefront of the study and adoption of scientific methods for the discovery and production of petroleum.

doned because it would not flow. The first producing well was brought in by the Savage brothers on March 28, 1906. By 1910 Caddo was the largest oil field in the state and was also supplying gas to several cities. It produced over 5,000,000 bbl. in that year to outrank Jennings, Welsh, and Anse la Butte.

North Texas Active

The flood of oil from Glenn pool had a tendency to slow drilling for a time, but in 1911 Electra field in North Texas was discovered although output did not reach its peak until several years later. The discovery of oil in this area did stimulate wildcatting and resulted in a number of new pools being opened.

The great Cushing field of Oklahoma was opened in 1912, and in 1914 its flood of oil again broke the market for a time until the larger demand created by World War I took up the surplus and caused prices to increase. The discovery of Healdton in 1913 and Blackwell in 1914 also helped Oklahoma remain the leading oil-producing state.

The anticipated increased demand for oil caused by World War I resulted in great drilling activity in Oklahoma in 1914 and 32 new fields were discovered in that year. Texas, too, was active with the discovery of Iowa Park in 1913 and a deep sand at Sour Lake in 1914.

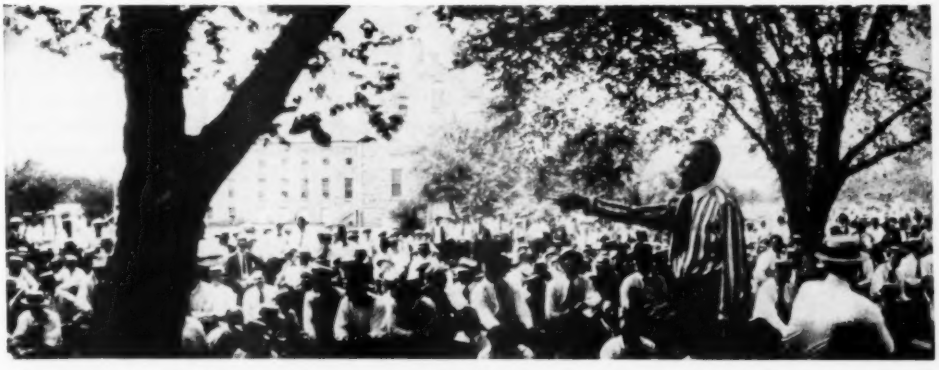
First Osage Sale

The first of the now famous Osage sales began during this period. With Colonel Walters as auctioneer, oil leases on quarter-section tracts in the Osage Indian Nation in Oklahoma were auctioned to the highest bidders. The first sale of tracts in the Burbank district brought sums below $1,000 for a 160-acre tract. The field

The first store and general office of Jones & Laughlin Supply Co. was erected and opened in Bartlesville, I. T., in May 1905. This store, still active, is northern Oklahoma headquarters.

was opened in 1920 and later sales saw leases on Burbank tracts of 160 acres sold for as high as $1,990,000, while a number of quarter-sections brought the Indians over $1,000,000 each.

It was during this period that formal petroleum-engineering education was introduced in the Southwest. A young oil operator from Oklahoma, M. H. Valerius, appeared at Missouri School of Mines in 1912 with a request for a course in petroleum geology. Such a course was not offered at this time, but V. H. McNutt, a young geology instructor, was designated to instruct Valerius. The next year the



Total bonuses of $4,478,250 were paid for oil leases at this Osage Nation auction in Pawhuska, Okla., June 14, 1921. The auctioneer is Col. E. Walters. The industry has paid the Osage Nation more than $300,000,000 in royalties, bonuses, and rentals.

Many an old-timer who worked in Desdemona, Tex.—better known as Hog Creek—during the boom days of 1919 will remember such a scene as this which shows the town's Main Street. Desdemona's population went from 50 to 16,000 in less than a year.

school offered elective courses in petroleum geology and in 1914 a course in petroleum production methods was added.

An important event during this period was the founding in 1910 of the U. S. Bureau of Mines with J. A. Holmes as director. The publications of the bureau on subjects related to the oil industry, particularly the production end of the business, have exerted a considerable influence. The early technical papers and bulletins issued by the bureau covered safety measures and the reduction of waste. The bureau made its influence felt in the Southwest early in its history. Engineers of the bureau were assigned to Cushing field at the height of the boom in 1913-14.

World War 1 to East Texas

KANSAS, the pioneer oil-producing state of the Southwest, was only a small producer up to the discovery of oil in Butler County. Butler County was known as a gas-producing area but no one had had any success in prospecting for oil until a gas test drilled by one of the Doherty gas subsidiaries found oil in the Augusta area in 1914 and really opened the field with a big well in 1915. The county developed a large number of pools close to each other, notable among them being Eldorado field in 1915. The Henry L. Doherty interests held a number of leases in Eldorado field. These were the cornerstone of Empire Gas & Fuel Co., which later was the nucleus of Cities Service Co.

Towanda pool of Butler County, opened in 1917, was one of the richest ever developed in the United States in a small area. Wells of 10,000 bbl. and upward to 20,000 bbl. in initial production were found in this pool. The development of the field was during a time of good market prices. The adjoining county of Greenwood also developed good-sized pools.

Kansas produced 45,451,000 bbl. in 1918 as against 2,823,000 bbl. in 1915, and considerably over 40,000,000 bbl. of the 1918 production came from Butler County, otherwise known as Eldorado-Augusta field, ranking it among the great fields of all time in flush production.

Kansas outranked Texas in 1918 as the latter big state produced only 38,750,000 bbl. in that year.

Huge Gas Reserves Found

In 1917 the huge Monroe gas field of northern Louisiana, which now covers more than 350 sq. miles, was being rapidly developed. (It had been discovered in 1909.) In 1918 an even larger southwest gas reserve was opened up with the discovery of Panhandle field in Texas. By 1925 it had become the world's largest gas field, covering 1,350,000 acres.

A third major gas reserve for the Southwest was Hugoton field, which surpassed its predecessors. It was discovered in 1930 and today is 150 miles long and 35 miles in width, covering portions of Oklahoma, Texas, and Kansas. Hugoton has gas reserves representing 15 per cent of the nation's total, and has replaced Panhandle field as the world's largest dry-gas field.

Texas began an oil comeback in 1918 and 1919 with heavy production from Ranger, Burkburnett, and other North Texas fields. However, Oklahoma and California were still outproducing the Lone Star state. The discovery well of Ranger field in Eastland County, Texas, was completed in October 1917 and peak

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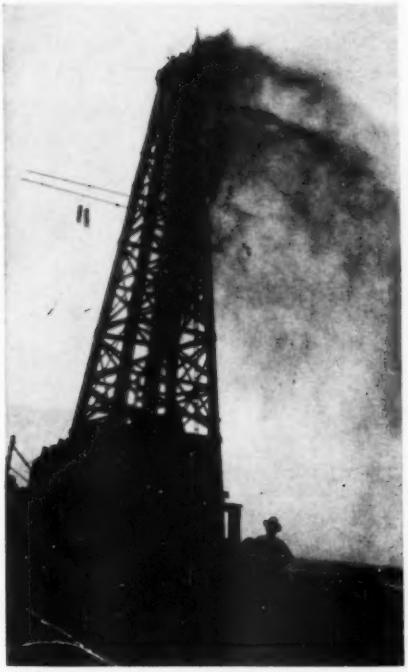


The opening in 1923 of Big Lake field in West Texas by Texon Oil & Land Co. 1 Santa Rita was of great significance to University of Texas and Texas A. & M. College. These two colleges share ownership in 2,000,000 acres of oil-rich land in West Texas. The Santa Rita well was the first oil production on the acreage. Since that time, over $110,000,000 revenue has been received by the schools from the oil-rich land. Contrary to popular opinion, the schools may spend only the interest from this huge fund.

production was reached in July 1919 with 80,000 bbl. daily.

Oil had been found in small quantities at Burkburnett, Wichita County, in 1912, but it wasn't until the discovery of townsite production in 1918 that the big development began. The well which started the Burkburnett boom was drilled by a partnership composed of Shields L. Fowler, now living on a ranch near Fort Worth; his brother, Movle Fowler; Will Daniel; Walter D. Cline; and several other friends who contributed sums of money toward the venture.

The well blew in on July 29, opening one of the most colorful chapters in oil history and establishing Burkburnett as one of the last of the shack-infested boom towns. Three weeks after completion of the discovery well, 56 rigs were reported active in Burkburnett field.

Oil companies were founded almost hourly and stock was sold at sidewalk stands in nearby Wichita Falls. Sixty-nine firms in the "Wichita Oil and Stock Exchange" had quotations listed in a Wichita Falls paper of September 17, 1918. In all, more than 400 firms offered stock for sale at local exchanges during the boom. Of these, probably not more than 15 or 20 ever paid dividends or returned any part of the capital investment.

Increased Production for Oklahoma

Oklahoma advanced from 139,000 bbl. in 1903 to 103,347,000 bbl. in 1918 or from an average of 381 bbl. to an average of 283,143 bbl. per day. Oklahoma's tremendous growth was brought about by the discovery and development of the wonderful Cushing-Shamrock field which had a peak production variously estimated at 305,000 to 330,000 bbl. per day in April 1916, and Healdton pool which had a peak close to 100,000 bbl. Production in the state spread to many counties and the annual output increased steadily. The decline of one field was more than made up by new discoveries.

Under the stimulus of World War I demand and the inflationary boom which followed the war, posted crude prices climbed to new highs. Kansas and Oklahoma crude brought $3.50; Healdton, Oklahoma, $2.75; Corsicana heavy, $2; Corsicana light, $3; Electra and Henrietta (North Texas), $3.50; Caddo, Louisiana, from $2.50 to $3.50, according to gravity; DeSoto, Louisiana, $3.40; Crichton, Louisiana, $3; Red River, Louisiana, $1.50 to $2.55, according to gravity; Homer, Louisiana, $3.10 to $3.25; and Gulf Coast Texas and Louisiana, $2.50.

In 1920 development of the Osage Nation lands in Oklahoma reached its height with the discovery of the prolific Burbank oil field, 20 miles east of Ponca City. Fabulous prices were paid for the lands which were auctioned off by Col. E. Walters of Skeedee, Okla. At a sale held June 28, 1922, Henry McGraw of Gypsy Oil Co., made five bids, some of $1,000,000 or more. He spent over $3,000,000 for five tracts of land that afternoon. That sale alone provided $49,000 each for every man, woman, and child in the Osage Nation.

Tonkawa field, known as "Three Sands," was a latter spectacular oil-pool development.

Boom at Seminole

It was in the 1920's that the Greater Seminole area of Oklahoma became an important factor in southwest crude production. The term "Greater Seminole," as now used, embraces a large number of fields located largely in Seminole County, but extending into four neighboring counties. Among the fields in Greater Seminole are Carr City, Bethel, Earlsboro, East

This early shot of a "phantom" woman entering the Deep Test Cafe was taken at Garber, Okla., in the 1920's.

Earlsboro, South Earlsboro, Hotulke-West Earlsboro, Seminole City, East Seminole, North Seminole, West Seminole, Searight, North Searight, Bowlegs, Little River, East Little River, Maud, South Maud, Mission, St. Louis, and East St. Louis.

Development of Greater Seminole was initiated by the R. H. Smith et al., 1 Betsy Foster, a 2,800-bbl. producer which was brought in 1 mile south of Wewoka on March 17, 1923. This was the start of Wewoka field—the first of a large number of fields which were to be discovered in the next 7 years.

The year 1926 was a big one for Greater Seminole with three large fields coming in during a 2-month period. Earlsboro came on March 1, Seminole City on March 7, and Searight on April 21. Earlsboro was noted for its high individual well production which ranged between 1,000 and 4,000 bbl. daily.

Peak production for Greater Seminole came on July 30, 1927, when the 10 major fields of the area were making 527,400 bbl. of oil daily. The five largest fields at this time were Seminole, Searight, Earlsboro, Bowlegs, and Little River. Within one 10-year period Greater Seminole produced crude estimated to be worth more than 1 million dollars. The heavy production of the area helped bring about a sharp break in crude prices in 1927. On February 22, 1927, a major purchaser posted Kansas and Oklahoma prices ranging from 15 cents a barrel for 28°-28.9°-gravity oil to 39 cents for 40° gravity and above. Similar reductions were posted in North and Central Texas.

Deep Drilling at Oklahoma City

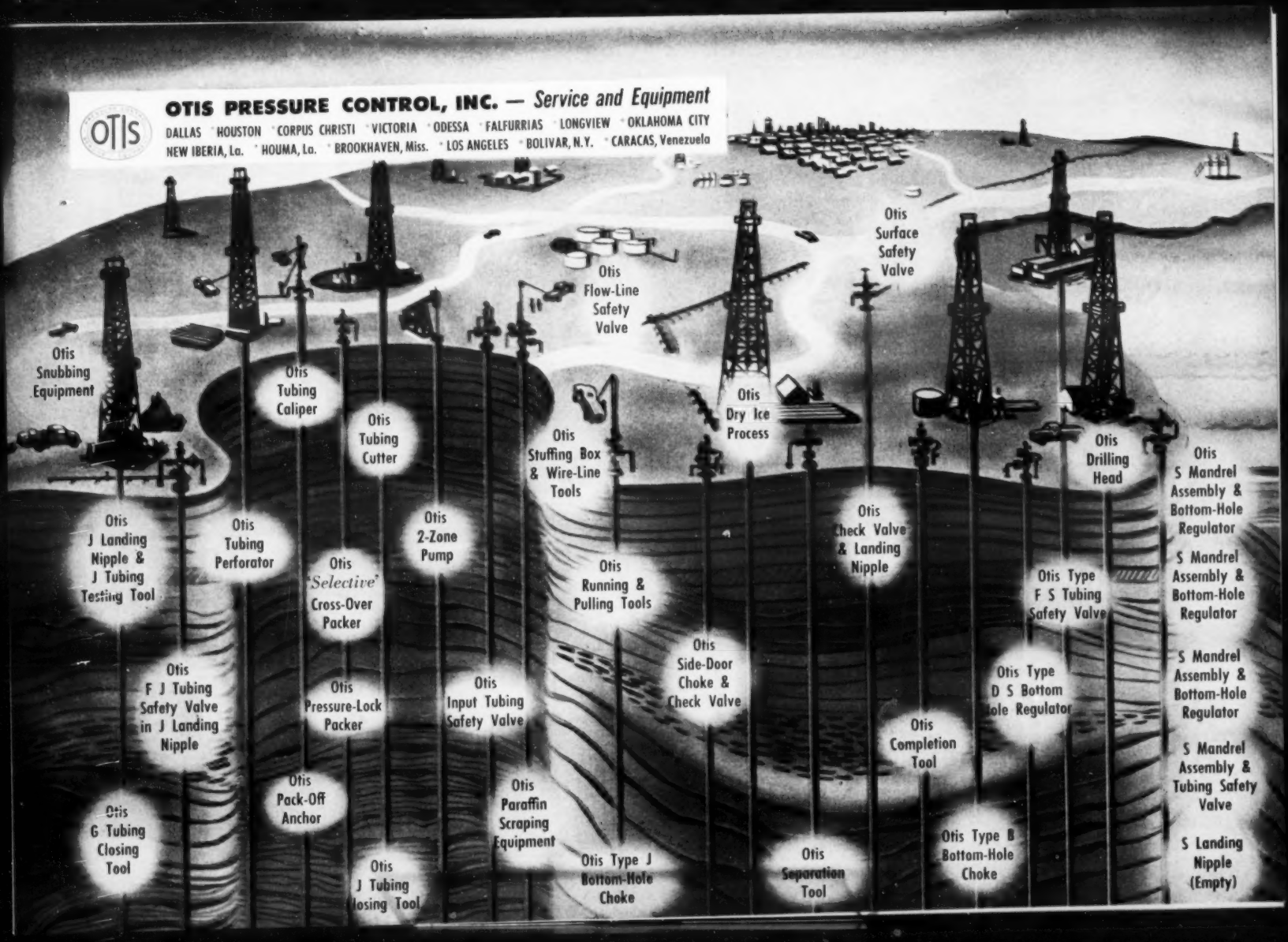
In 1928 the famous Oklahoma City field was brought in by the Foster Petroleum Co.-Indian Territory Illuminating Oil Co. 1 Oklahoma City on a lease 6 miles south of the city. The test blew in on December 4 while a cement plug was being drilled at 6,355 ft. By March 1930 there were 135 completed wells and 173 drilling wells or locations in the field. Oil production was at the rate of 14,500,000 bbl. annually. By 1935 Oklahoma City was the second-largest field in the country and 1,713 wells had been drilled. Extensive townsite drilling was carried on with wells drilled right up to the steps of the state capitol.

The development of Oklahoma City field presented some operating problems not previously encountered in the Southwest. The deep production and high pressures of the field challenged the industry. The practices and equipment developed at Oklahoma City were to prove extremely helpful in the years of deep and high-pressure production to follow.

Texas in the Early Twenties

There were still some booms during the twenties in Texas but nothing to compare with Burkburnett and Ranger. More orderly development of fields was becoming the rule. Some of the more significant discoveries in the early twenties were Mexia in 1920, Powell in 1923, and McCamey in 1925. During this same period the art of geophysics was applied to oil exploration on the Texas Gulf Coast. The discoveries of Allen, Fannett, Long Point, Nash, and Orchard in 1924 and 1925 were credited to this new science.

It was in the early twenties that the Texas Panhandle got its first oil well. (The famous Panhandle gas field had been opened in 1918 by Amarillo Oil Co.) On April 5, 1921, the Gulf Production Co. 2 Burnett in Carson County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Otis Check Valve & Landing Nipple
Otis Type F S Tubing Safety Valve
S Mandrel Assembly & Bottom-Hole Regulator
Otis F J Tubing Safety Valve in J Landing Nipple
Otis Pressure-Lock Packer
Otis Input Tubing Safety Valve
Otis Side-Door Choke & Check Valve
Otis Type D S Bottom Hole Regulator
S Mandrel Assembly & Bottom-Hole Regulator
Otis Completion Tool
Otis Pack-Off Anchor
Otis Paraffin Scraping Equipment
S Mandrel Assembly & Tubing Safety Valve
Otis G Tubing Closing Tool
Otis J Tubing Closing Tool
Otis Type J Bottom-Hole Choke
Otis Separation Tool
Otis Type B Bottom-Hole Choke
S Landing Nipple (Empty)

23 Years After Spindletop....
HERCULES WAS BORN

It was a long time from Spindletop to 1924, when Hercules Tool Company was organized; but actually the Oil Industry was still in its infancy. Progressing with the Industry HERCULES is proud of the part it has played in the Industry and is proud of these "firsts":

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Originator of a Tubing Hanger with "overhead packing," repackable without having to lift Tubing or disturb the well connections.

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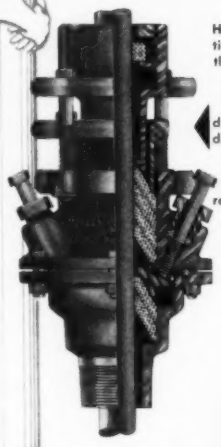
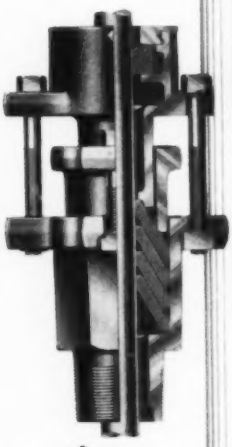


Hercules combination upset and plain thread pumping and flowing tee.

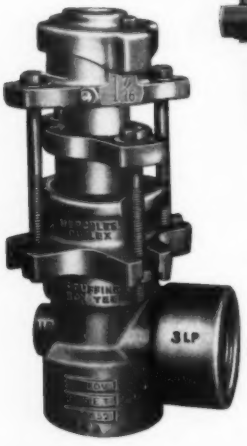
Hercules duplex polished rod double packed stuffing box.

Hercules regular type tubing hanger.

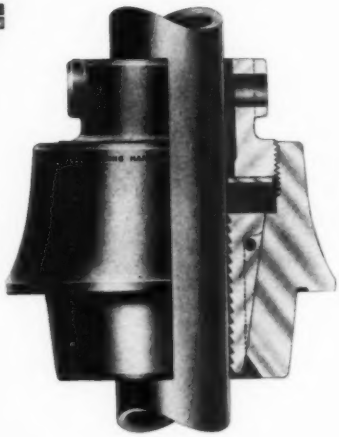
Hercules split cone packing rings.



Hercules regular type duplex polished rod stuffing box.

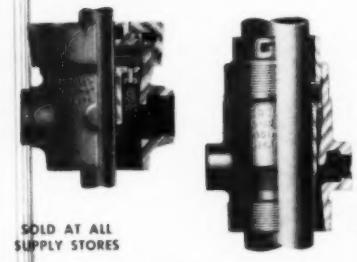


Hercules tee base type duplex polished rod stuffing box.



Hercules type "SOS" stripper tubing head.

Hercules type "SO" tubing head.



Hercules type J-3 tubing head.

Hercules type G-10 casing head.

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The Phillips brothers (Phillips Petroleum Co.) on one of their first producing leases. Left to right, L. E. Phillips, Phil (son of L. E.) and Frank Phillips.

An effective sign warns visitors of the presence of gas at a Garfield County, Okla., well in the 1920's.

was completed at a depth of 3,052 ft. for an initial 175 bbl. daily. Five years later the Panhandle area got another stimulus with the opening of prolific Borger field by Dixon Creek Oil & Refining Co. 1 Smith, a 10,000-bbl.-daily well. In 9 months the field had 813 wells producing 165,000 bbl. of oil daily.

Permian Basin Discoveries

It was in the late twenties that the Permian basin of West Texas and southeastern New Mexico came into its own. A little production had been found in 1920 at Westbrook pool, Mitchell County, Texas. It was not until 1923, however, with the completion of the Santa Rita discovery well of Big Lake field that the area boomed. This important test was drilled by Texon Oil & Land Co. 90 miles southwest of Westbrook field.

McCamey field was opened in the Permian basin in 1925; Yates, Hendricks, and McElroy in 1926; and Howard-Glasscock in 1927. By 1929 the Texas portion of the basin was producing 360,000 bbl. daily as compared with 4,000 in 1924 and was pouring forth half the state's production.

Yates was probably the outstanding field of this period. By July 1929 the 306 wells in the field had a potential open-flow capacity of more than 4,500,000 bbl. a day. One well, the Standard Oil Co. of Texas 3 Bob Reid reached a potential rating of almost 170,000 bbl. a day.

Oil in New Mexico

First production in the New Mexico portion of the Permian basin dates from 1923. In that year a small oiler was completed in Eddy County to open up Artesia oil field. The next year Maljamar field in Lea County was brought in by Maljamar Oil & Gas Corp. Things were fairly quiet in New Mexico for a few years, but the finding of Yates, Hendricks, and McElroy fields in Texas spurred interest in the state.

In 1927 a huge gas well was drilled by Texas Production Co. at Jal, Lea County. The next year Midwest Refining Co. hit oil near Hobbs to open Hobbs field—first major field for New Mexico. By January 1931 nearly 7,000,000 bbl. had been taken from the field's 130 wells.

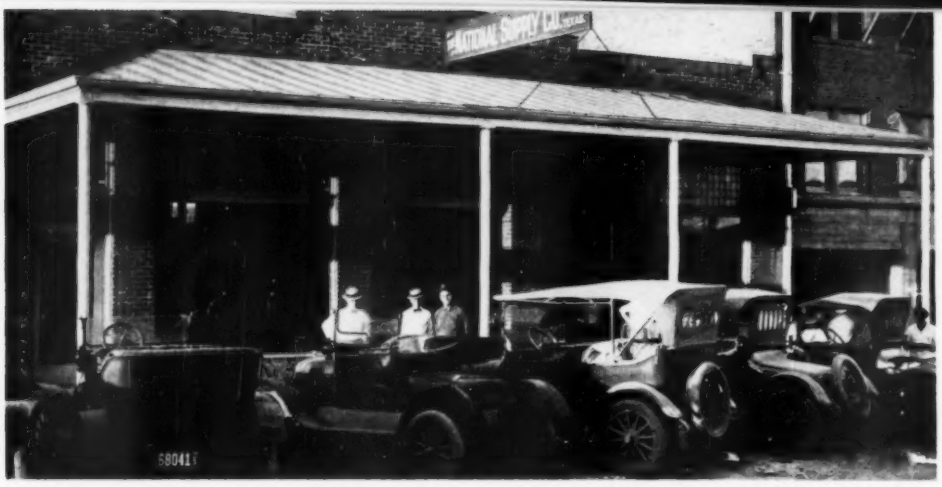
Black Gold in Arkansas

During the same period of the Burbank field development of Oklahoma, the State of Arkansas entered the oil picture. The first oil well in the state was Hunter Oil Co.'s 100-bbl. producer which was brought in on April 14, 1920, near Stephens in Ouachita County. However, this field never became a major oil producer.

The big boom in Arkansas started on April 22, 1920, when the Constantin Refining Co. 1 Hill at El Dorado blew in with an estimated flow of 40,000,000 cu. ft. daily of gas and 8 bbl. of oil. It was not until January 10 of the next that a substantial oil producer was completed in El Dorado field. By June 1921 more than 100 wells had been drilled and 340 derricks were being erected to drill others. Three months later production had climbed to 74,364 bbl. a week.

An active exploration campaign set off by El Dorado resulted in the discovery of Irma field in October 1921, and East El Dorado, Woodley, Smackover, and Stephens in 1922.

In northwestern Louisiana, across the bor-



A scene on "Supply Row" at Ranger, Tex., during World War I. The many essential services of the oil-country supply store have always become available immediately after the completion of the discovery well of a new field.

der from the big oil production in southwestern Arkansas, there was also considerable activity in the second decade of the 1900's. Caddo field, which started producing in 1904, continued to be the major field in the area. However, several other good fields were found—Homer in 1920, Haynesville in 1921, and Rodessa gas field in 1930.

Enter the Petroleum Engineer

While it is difficult to state who was the first petroleum engineer, it can be said that engineers gained a firm foothold in the industry between World War I and the East Texas boom. The early petroleum engineers were generally not employed as such but rather as mechanical engineers to assist the production superintendents. Many of the improvements in drilling and producing equipment can be traced directly to the work done by engineers for oil companies.

Early Oil Search

As oil-producing and drilling practices became more and more technical the need for research was recognized. One of the first research funds was established on November 15, 1925, by John D. Rockefeller under the auspices of the American Petroleum Institute. It provided $250,000 for scientific research in petroleum geology, physics, and chemistry. About the same time an additional $250,000 was made available to the Institute by Universal Oil Products Co. of Chicago.

East Texas to Scurry

THE overwhelming ascendancy of Texas as the largest crude producer in the Southwest and in the nation marks the two decades from East Texas to Scurry. In 1930 the state produced 290,457,000 bbl.; by 1940 this figure was doubled, and in 1950 the total was 831,780,000 bbl. or almost three times the 1930 figure. In 1950 it produced 42 per cent of the nation's crude and had 2½ times more production than California, its closest competitor.

The lessons of East Texas and Oklahoma City laid the groundwork for two decades of well-regulated and scientific production practices in the Southwest. Boom towns became a thing of the past—at least the rowdy, uncontrolled boom towns of earlier days. The day of big discoveries was not over, however.

The Biggest Yet

The huge East Texas field was opened by D. M. (Dad) Joiner, an Oklahoma wildcatter, on October 5, 1930. Development in the field was fast because of the high production and the easy, inexpensive drilling. The field soon covered more than 140,000 acres in five East Texas counties and was 40 miles in length. Production climbed quickly to a daily average of 300,000 bbl. in 1931 and 580,000 bbl. in 1933. For a period early in August 1931 production was more than 1,000,000 bbl. daily.

East Texas has been described as "the nation's biggest and most trying oil boom." Wells were punched down as fast as possible, land values went sky-high, and such towns as Kilgore, Longview, Henderson, Overton, Tyler, and Gladewater were as active as Beaumont had been in the first Texas oil boom 30 years earlier.

With tremendous overproduction wrecking the market Governor Murray of Oklahoma ordered the militia to control the supply at

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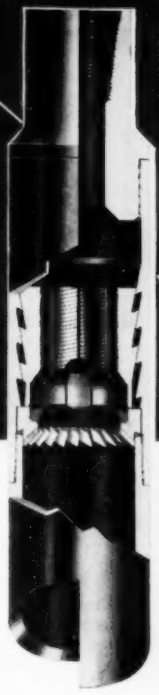

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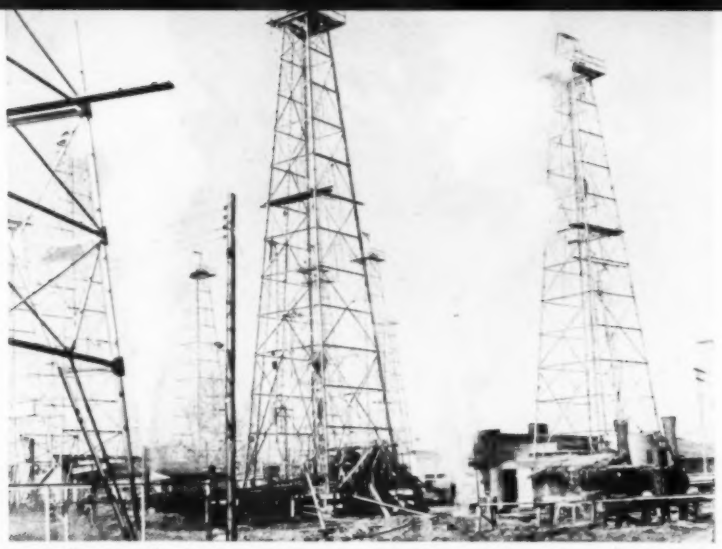

Development was fast in the fabulous East Texas field which Dad Joiner discovered on October 5, 1930. Within a year, production from the nation's largest field reached 300,000 bbl. daily.

Oklahoma City pool until "oil became a dollar a barrel." The Texas Railroad Commission ordered a curtailment of production in East Texas field, but the order was ignored or evaded until Governor Sterling of Texas sent troops to enforce it.

Even with troops in the oil fields the flow of "hot oil"—oil produced in excess of quotas set by state regulatory bodies—continued. The flood of oil broke the market and oil was selling for less than 25 cents a barrel at times.

In sharp contrast to the chaotic conditions which prevailed during the boom period, East Texas today is a prime example of modern conservation methods. Through the effective action of the Texas Railroad Commission and the cooperation of producers, the field's production is being held high. Regulation of producing days and daily allowables plus salt-water injection to maintain the field's water drive is assuring the field of a long life.

The salt-water-injection program alone, it is estimated, will increase the field's total yield of oil by 600 to 800 million barrels. (At a price of $2.65 per barrel, this oil is worth between 1.5 and 2 million dollars.) The close control of the reservoir has kept 13,000 of the field's 22,000 wells flowing after 20 years of life. Presently, East Texas is yielding a daily average of 270,000 bbl. and bottom-hole pressure has been kept above 1,000 psi.—a good figure for a 20-year-old field.

East Texas, by any standard, can undoubtedly be labeled the nation's largest and most important oil field. The field has produced the amazing total of 2.7 billion barrels of crude, or 1 out of every 14 bbl. produced by the entire world since 1930. It is estimated that its total recovery will be 5 billion barrels.

Other than East Texas many major fields were discovered in Texas in the past 20 years. Among these were

Thompson, Nueces County, 1931; Greta, Refugio, 1933; Hastings, Brazoria, 1934; Old Ocean, Brazoria, 1934; Tom O'Connor, Refugio, 1934; Anahuac, Chambers, 1935; Goldsmith, Ector, 1935; Foster, Ector, 1936; Hendricks, Winkler, 1936; Seminole, Gaines, 1936; Talco, Titus, 1936; Seeligson, Nueces, 1937; Slaughter, Hockley-Cochran, 1937; Wasson, Yoakum, 1937; Webster, Harris, 1937; West Ranch, Jackson, 1938; Hawkins, Wood, 1940; Fullerton, Andrews, 1941; Quitman, Wood, 1942; TXL, Ector, 1945; Benedum, Upton, 1947; and Snyder, Scurry, 1948.

The discovery of oil in Scurry County, West Texas, in 1948, set off a development campaign which has been the most spectacular since East Texas. A number of large fields—notably Kelly-Snyder, Sharon Ridge, and Diamond M—have been opened up in the Kent-Scurry-Borden county area. A recent estimate gives Kelly-Snyder field alone an original oil-in-place figure of 2.5 billion barrels which, for a new field, compares well with East Texas' 5 billion barrels.

Louisiana Becomes Second Largest

Extensive oil discoveries have been made in Louisiana in the past two decades. They have boosted the state to the second largest crude producer in the Southwest and third

In 1901 Broderick & Bascom was an **old hand** at making wire lines for the oil industry

Shooting the Renfrow No. 13 near Bartlesville, Oklahoma — reproduced from a photo in the August, 1908, issue of B & B's house organ, *The Yellow Strand*.

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Miniature reproduction of a January, 1908, B & B ad in The Oil and Gas Journal

Hats off to the men of Spindletop . . . to The Oil and Gas Journal's founders . . . to all pioneers who helped to set the modern oil industry in motion.

Broderick & Bascom had a running start for the golden half century just ended. During 1901—the year of the Lucas gusher—we were celebrating our 25th anniversary. An oil-field user of the early nineties wrote: "I have never seen a wire line to equal your lines in wear." Distributors in such separated oil states as Pennsylvania and California were joined by B & B suppliers in the booming fields of Oklahoma, Kansas and Texas. As broader exploration and deeper wells followed, tough Yellow Strand became a mainstay of contractors and operators.

Today, for every drilling, pipe-laying and refining installation there's a Broderick & Bascom line that has grown up with the industry—a product of 75 years of experience. It's a long-lasting, economical line. Specify Preformed Yellow Strand for high production in the vital period ahead.

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BECKWITH MACHINERY COMPANY: Pittsburgh, Pennsylvania, and Branches
BOVAIRD & COMPANY: Bradford, Pennsylvania
THE SANDY SUPPLY COMPANY: Wooster and Zanesville, Ohio
ALLIED SUPPLY CO.: Los Angeles, California
ATLAS SUPPLY CO.: Bakersfield, California

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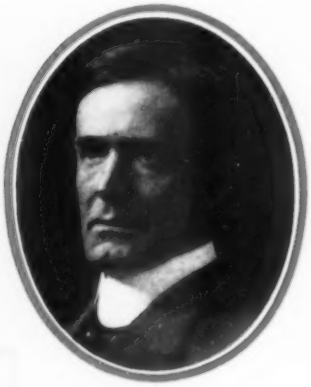

WALTER B. SHARP
Pioneer Spindletop
Oil Producer

W. T. CAMPBELL
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Spindletop Pioneer,
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MISSION'S HERITAGE DAT

An Unus

MISSION is celebrating its Twenty-Fifth Anniversary in the year in which Spindletop celebrates its Fiftieth . . . but it can be shown that MISSION'S background of oil experience extends back to the first days of Spindletop! It is an unusual story:

It begins with Walter Sharp, father of Bedford and Dudley Sharp and a famous figure in Texas oil history. When only 18 years old, Walter Sharp embarked in the business of drilling water wells, at Dallas, using one of the first rotary rigs every employed in Texas. Five years later, in 1893, when the Gladys City Oil, Gas and Manufacturing Company at Beaumont, was ready to drill its first test for oil at "Big Hill", later called "Spindletop" . . . it fell to the lot of Walter Sharp to get the drilling contract. His well, only 30 yards from the site of the future Lucas Gusher, after many vicissitudes sanded up tight at 418 feet. Money had been exhausted, and the well was abandoned.

Late in 1900, Mr. Sharp, convinced that the Lucas Well, then drilling, would strike oil, arranged with a Dallas friend, Ed Prather, to meet him at Spindletop on January 2nd. Business engagements interfered, but when the Lucas Well roared in on January 10th, Walter Sharp arrived on the scene a few hours later, from New Orleans, having wired Mr. Prather to meet him there with all the cash he had or could borrow.

Messrs. Sharp and Prather became associated in the Drillers Oil Company, formed at Spindletop and which operated also at Sour Lake, Batson, and Humble. They were also later associated with Howard Hughes, Sr., another Spindletop pioneer, in forming the Moonshine Company to provide air and gas lift in the Spindletop Field.

Mr. Sharp became a large trader in leases, also did a large drilling contracting business, and soon came to rank as one of the state's leading oil producers. Eventually, he organized the Producers Oil Company, which was later acquired by The Texas Company, constituting that company's first entry into the oil producing business.

Mr. Sharp was the first driller to use mud instead of water for rotary drilling, his initial experiments being made at Corsicana, prior to Spindletop. The Hamill brothers were drilling for him at Corsicana at the time; and it was by using mud instead of clear water, later, at Spindletop, that the Hamills were able to get the Lucas Well down through the quicksands.

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Board Chairman,
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Executive Vice-President,
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ES BACK TO SPINDLETOP!

ual Story

To Mr. Sharp also belongs the distinction of building the first oil refinery in Texas. This was in 1896, at Sour Lake, where he had drilled some shallow wells for the Liberty Oil Company. This small refinery, which produced eight grades of oil, including "headlight oil", was destroyed by fire in 1898. Another of Mr. Sharp's pioneer services to the industry was his part in the development and financing of Howard Hughes' rotary rock bit, which was first introduced as the Sharp-Hughes Rock Bit. After Mr. Sharp's death, in 1912, Mr. Hughes acquired his interest in the bit.

W. T. Campbell, Sr., was also a Spindletop pioneer. Mr. Campbell was the moving spirit and general manager in the famous Hogg-Swayne Syndicate which acquired important acreage just East of the Lucas Well. Later, Mr. Campbell became one of the original incorporators of The Texas Company.

It is not strange that members of the Sharp and Campbell families, in the next generation, having been intimately familiar with the problems of rotary drilling from early childhood . . . entered the rotary drilling equipment business when the time came for them to choose careers. Nor is it strange that their lifelong friend, Ed Prather, became associated with them in this enterprise. Their initial entry into the business, in December 1925, was as the Mission Sales Company, organized to distribute a line of rotary drilling equipment. In October, 1932, the company was reorganized as the Mission Manufacturing Company, for the purpose of manufacturing rotary drilling specialties. A small machine shop on Railroad Avenue in Houston was its first plant. In March, 1935, the company moved into its present modern plant on Humble Road. Officers of the company are W. Bedford Sharp, board chairman; Dudley C. Sharp, president; W. T. Campbell, Jr., executive vice-president and sales manager, and Ed Prather, treasurer.

MISSION has established a worldwide business upon the policy of producing only the finest equipment that field and laboratory research can develop. Its principal products are Mission Slush Pump Pistons, Piston Rods, Liners, Valves, and Self-Sealing Packings; Mission "Rolling Dog" Rotary, Tubing, and Casing Slips; Mission Tubing Swabs; Mission Plug Valves; and Mission "Streamlined Flow" Centrifugal Pumps. Since Mr. Walter Sharp was the pioneer in using mud for rotary drilling, it is of special interest that MISSION'S earliest manufactured products — expendable slush pump parts — have made an outstanding contribution to the efficient handling of rotary drilling mud.

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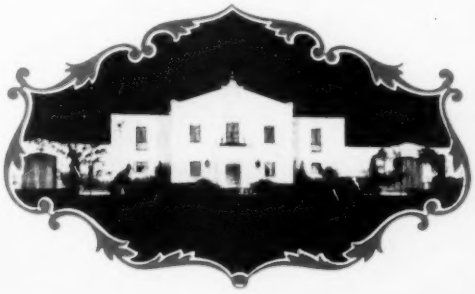

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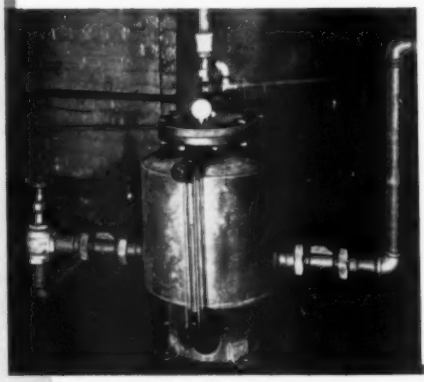

Operated by air, gas, or steam pressure, pumps (without clogging) any liquid that will flow through pipes. Lifts fluid from lower level and discharges against pressure approximately equal to operating gas pressure. Operates automatically by ejector that exhausts the vessel . . . drawing in liquid . . . then gas pressure pushes it out. Ejector and its control valve not in contact with fluid pumped. Corrosion proofing easy. Write for Bulletin 5030.

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PENBERTHY *Explosion Proof* SUMP PUMPS

Motor and switch totally enclosed, this pump has Underwriters approval for Class I, Group D, and Class II, Groups E, F and G hazardous locations. These include gasoline, solvent vapors, metal dust, natural gas, carbon black, naphtha, alcohol, grain dust, acetone, lacquer, coal and coke dust, etc. Made of copper and bronze throughout, this pump is corrosion proof, durable, thoroughly dependable. Write for Bulletin 4929.

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Established 1886 — *Canadian Plant, Windsor, Ontario*

in the nation, being behind Texas and California. Among the major new fields of the past 20 years which have contributed to the spurt in Louisiana output are: Rodessa, Caddo Parish, 1930; Lake Washington, Plaquemines, 1931; Roanoke, Jefferson Davis, 1934; Bosco, Acadia, and St. Landry, 1934; Lake Hermitage, Plaquemines, 1934; Creole, Cameron, 1938; Nebo-Hemphill, LaSalle, 1940; Bayou Sale, St. Mary, 1940; Delta Farms, Lafourche and Jefferson, 1940; Erath, Vermilion, 1940; West Bay, Plaquemines, 1940; Lake St. John, Concordia and Tensas, 1942; Egan, Acadia, 1943; Good Hope, St. Charles, 1944; Weeks Island, Iberia, 1945; and West Barataria, Jefferson, 1947.

Creole field of 1938 was the first oil pool in the open waters of the Gulf of Mexico. After this initial discovery, little exploration was done in gulf waters until the end of World War II when a real boom started in the waters off Texas and Louisiana. Some 35 operators, large and small, expended an estimated 200 million dollars in the postwar years. By late 1950, 11 oil fields had been discovered. Total production from these fields was 16,500 bbl. per day. Eighteen gas or gas-condensate fields had been found, but only one pipe line had been laid to transport this gaseous production to shore.

Mississippi Becomes an Oil State

It was not until 1939 that Mississippi got its first commercial oil field. In that year Union Producing Co. brought in Tinsley field of Yazoo County with its 1 G. C. Woodruff. Gas production in the state preceded oil by 13 years. On October 6, 1926, Amory Petroleum Co. brought in a small gas field near the city of Amory in Monroe County.

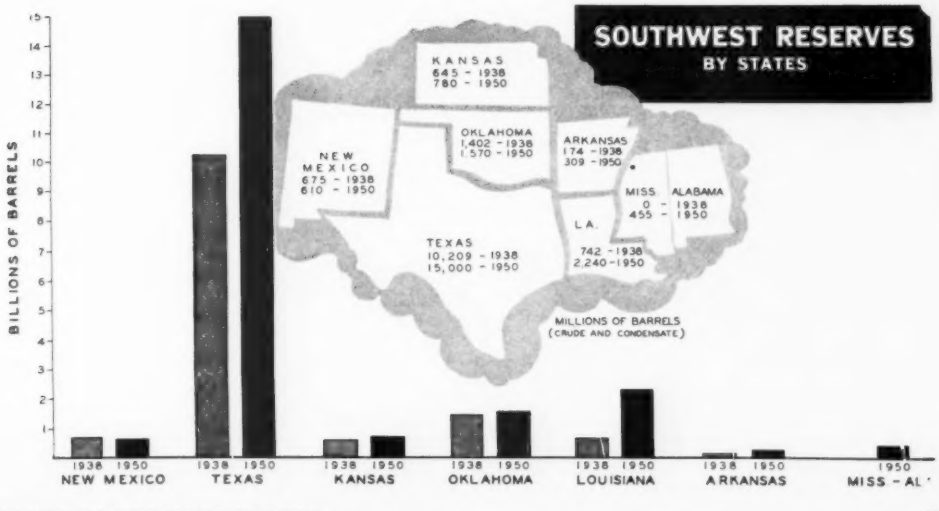
Within 6 months after the state's first oil at Tinsley, Pickens oil field of Yazoo County was opened by Kingwood Oil Co. In 1941 British-American Oil Co. discovered Cary oil field in Sharkey County.

A series of discoveries from 1943 to the present, a good many of them in the salt-basin area of central and southern Mississippi, have boosted the state to tenth in the nation in crude production. The daily crude production of over 100,000 bbl. which the state has achieved has been brought about by such fields as Baxterville, Brookhaven, Cranfield, Eucutta, Heidelberg, La Grange, Mallalieu, Pickens, and Tinsley.

Western Kansas Active

Extensive new discoveries in the western part of the state enabled Kansas to reach a new peak in its crude production by 1948 when it produced 108,119,000 bbl. In 1950 Kansas was the fifth-ranking producer of crude in the nation.

No major discoveries have been made in the older oil areas of the eastern part of the state in recent years. Among the larger fields discovered since 1930 are: Silica, Barton County, 1931; Stoltenberg, Ellsworth, 1931; Burrton-Haury, Reno, 1931; Chase, Rice, 1931; Otis-Albert, Rush, 1934; Bemis-Schutts, Ellis, 1935; Bloomer, Barton, 1936; Kraft-Prusa, Barton



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Ft. Worth, Texas

1937; and Burnett and South Burnett, Ellis, 1937.

Gas in New Mexico

Production in New Mexico continued to come largely from the Permian basin area. Its peak production year was in 1948, when it produced 47,969,000 bbl. making it the eighth-ranking crude producer. Drilling activity remained high throughout the period with around 500 wells per year put down. Toward the end of the period considerable development drilling was done on gas prospects in the San Juan basin in the northwestern part of the state.

New Oil for Oklahoma

There were four major producing areas opened up in Oklahoma during the thirties and forties—all of which rank among the major pools in the nation. Fitts pool was the first of these in 1933. It was followed by the wartime opening of West Edmond in 1943; the Golden Trend area of Garvin and McClain counties in 1945; and Elk City in 1947.

Arkansas Revived

The oil picture was discouraging in Arkansas during the early thirties with the state's production steadily declining. Phillips Petroleum Co. revived the state though in 1937 with the discovery of Schuler, Union County, which developed into a major pool. The next year Kerr-Lynn Oil Co. opened Magnolia field of Columbia County, another good field. The forties saw the opening of Midway field, Lafayette County in 1942, and substantial new production in 1941 and 1945 in Stephens field which had originally been discovered in 1922. By 1944 the state's annual crude production leveled off at around 30,000,000 bbl. and has changed little since then.

CLAY-PIGEON SHOOTING RANGE BECOMES LUCRATIVE OIL FIELD

THE following recollection is from Joseph Waldeck, retired sales representative of the Lunkenheimer Co.

"Out in Kansas, around 1920, a group of 15 or 20 men formed a club called the 'Trapshooters' Club.' They bought a piece of land in the neighborhood of Augusta and Eldorado, Kans., about 30 miles east of Wichita, to practice clay-pigeon shooting.

"When oil drilling began in the surrounding countryside, they decided to pool their interests to raise enough money to drill a well on the shooting ground.

"The well they drilled turned out to be a sensational gusher—the famous 'Trapshooters' well.'"

Practices and Equipment

"The oil was secured from the well by a rope which ran over a pulley and was attached to a sheet-iron bucket. . . . A horse was hitched to the end of the rope and started across the prairie and the oil brought to the surface and dumped in a small metal tank. The farmers from the vicinity bought the oil for greasing livestock, mowing machines, and other farm machinery."

Such was one oil-producing method in the Southwest in 1901. The late Charles N. Gould gave the above description of production near Granite, southwestern Oklahoma, to Carl Coke Rister.

Down at Spindletop, Tex., producing problems were simpler. The wells came in flowing and were simply allowed to produce wide open through the casing.

Through the years since 1901 producing practices and equipment have become considerably more complicated and more technical. General developments in the various phases of producing oil will be discussed in the following paragraphs.

Testing

OIL in the cuttings, a roaring gusher, or easy digging for the bit were the usual signs of oil in early-day drilling. Today, a number of highly refined techniques are available for determining the productive possibilities of a drilling well.

Coring

For the producer, a core (sample of the drilled formation) can first tell whether or not a certain sand will be commercially profitable, and secondly show the physical characteristics of a producting formation so it can be wisely and efficiently developed.

Leschot, a French engineer, is believed to have made the first rotary core bit in 1863. It was around 1916 that core bits began to be used commercially in American oil fields. Widespread use of coring began in the early 1920's. Improved coring methods have overcome the original objection to the rotary system drilling that it did not give as much reservoir information as cable tool drilling.

One of the earliest pieces of equipment in the Southwest for obtaining cores was called a "Poor Boy" or "Texas" core barrel. It consisted of a short piece of pipe with V-shaped teeth cut on its lower end. It was run on the bottom of the drill pipe and when sufficient

In 1922, S. E. (Red) Manning, superintendent of production of Humble Oil & Refining Co., and D. K. Cason, electrical engineer for the same company, conceived the idea of utilizing a reduction gear applied to oil field pumping. In cooperation with Ross Sterling, at that time president of Humble, and the late W. C. Trout, president of Lufkin Foundry & Machine Co., the first geared pumping unit was manufactured in Lufkin and installed at Goose Creek, Tex., in 1923. This unit was assembled by the use of a standard industrial worm gear reducer and wooden walking beams. The unit pictured was installed at Hull, Tex., in 1923.

formation had been cut, the V-teeth were bent inward by putting the weight of the drill pipe on the barrel.

Coring equipment has been continually developed until today there are diamond-tipped core barrels, wire-line core barrels (in which the core can be retracted without pulling the bit out of the hole), "signaling" core barrels (which indicate when the barrel is full by stopping mud circulation), and highly improved conventional core barrels. There also are a number of coring devices on the market which will take a sample from the side of the hole if it is desired to make a core above bottom. The general types of side-wall coring devices include: punch-type, percussion-type, mechanical rotary type, and electrically driven.

Core Analysis

Along with the development of better coring equipment has come the highly specialized art of core analysis. As early as 1921, investigations were being made of the grain size and porosity and their effect on production. The increasing number of secondary-recovery projects widened the use of core analysis. In the middle twenties core analysis was conducted to determine the oil content of reservoirs. The widespread water flooding of the Mid-Continent area commencing in the middle thirties saw extensive use of cores to plan proper floods. Coring is also extremely helpful in determining the proper depth and method of completing a well.

HOW THE TEXAS CO. WAS NAMED

BUT for the difference of a few weeks time, today's Gulf Oil Corp. might be The Texas Co., and vice versa. In June 27, 1901, J. M. Guffey of Gulf's predecessor company wrote his general manager in Beaumont: "The executive committee propose the name 'Texas Oil Refining Co.'" The name was never adopted as J. S. Cullinan, M. P. Cullinan, and H. L. Scales had obtained a charter on March 28, 1901, for the Texas Fuel Co., predecessor of today's The Texas Co.

Drill-Stem Testing

After a possible producing sand has been found by coring, driller's log, or some other method, it was necessary, until the middle twenties, to set casing in the hole to test the sand. At that time drill-stem testing equipment was devised which makes it possible to test the productive capacity of a sand without setting pipe. The testing is done by using the drill pipe and a packer and valve arrangement. It has become a very common procedure in the oil fields of the Southwest with several types of equipment available for the work.

Logging

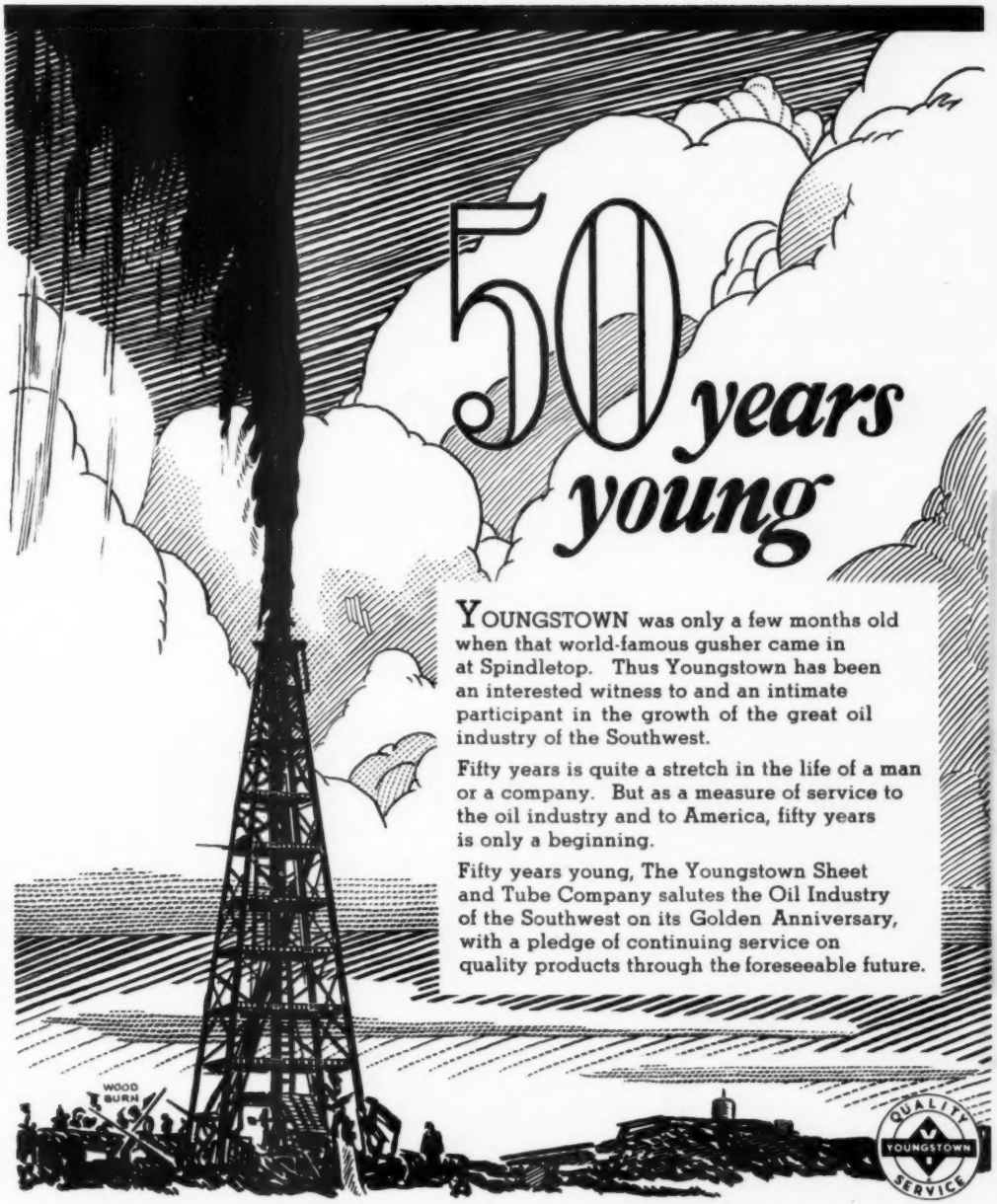
To supplement coring information, a number of logging methods have been devised. Perhaps the most widely used is electrical logging. It was in 1927 that Conrad and Marcel Schlumberger discovered a technique which they called "electrical coring." The first electric log was made in a well in Pechelbronn field of Alsace, France. It was in June 1919 when the new technique was introduced in the United States.

The many different logging methods have been classified by Hubert Guyod, consultant of Houston, as per the table below.

On the general question of well-logging methods Guyod says: "No universal logging

FISHING EXCURSION INTERRUPTED BY BURKBURNETT STRIKE

W. D. CLINE, who helped start the Burkburnett boom, was on a fishing trip in Louisiana when the northwest extension to the field was discovered. Hearing of the new strike, he rushed back to North Texas and paid $10,000 an acre for a 17½-acre lease near the new outpost well. He drilled one well, which flowed 2,000-2,500 bbl. daily, and sold the lease for $625,000. "The only thing I hated about it is that the damn bass were striking when I came home and when I got back they had quit," Cline says.



YOUNGSTOWN was only a few months old when that world-famous gusher came in at Spindletop. Thus Youngstown has been an interested witness to and an intimate participant in the growth of the great oil industry of the Southwest.

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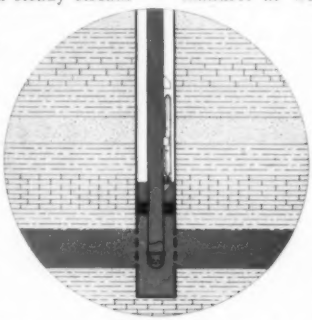

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WELL-LOGGING METHODS

No cross—not used; 1 cross—little used; 2 crosses—frequently used; 3 crosses—considerably used.

Method	Type	Properties investigated	Use
Acoustic	Sound intensity Sound velocity	Cohesion Elasticity—Density	
Chemical	Insoluble residues of samples	Mineral content	x
Mud logging	Hydrocarbon content of samples Gas detection in mud	Hydrocarbon content Gas content	xx xx
Electric	Natural potential Secondary potential Formation conductivity Mud conductivity High frequency response Polarization Transients	Electrochemical properties (?) (?) Salt water content—Texture Salt content Dielectric constant—Conductivity Electrolytic properties—Dielectric constant Misc. electric properties	xxx xxx x
Gravitational	Gravity	Density	
Intake	Water or gas intake	Permeability	x
Magnetic	Susceptibility Retentivity Rententivity decay	Effect of terrestrial field Effect of artificial field Coercive force	
Mechanical	Hole calipering Drilling rate Drilling reaction	Brittleness—Solubility Hardness—Compactness Hardness—Compactness Texture	xx xx xx
Optical	Examination of formations Examination of samples Fluorescence of formations Fluorescence of mud	Color—Texture Color—Texture—Content Oil content Oil content	 xxx xx
Radioactive	Natural radioactivity Artificial radioactivity	Radioactive substance content Hydrogen content	xx xx
Seismic	Wave velocity	Elasticity—Density	
Thermal	Gradient Thermal evolution	Thermal conductivity Brittleness—Solubility—Gas expansion	 x

method is available. A given method permits the solution of only a limited number of problems; however, an adequate combination of methods frequently supplies all the desired data."

Completion Practices

ONCE the pay sand has been located it is necessary to set pipe in the hole and bring the well in as a producer. During the early days of the Southwest, "open hole" completions were common. This consisted of setting pipe on a consolidated formation above the pay sand, drilling into the sand, shooting the well with nitroglycerin, and setting tubing at the bottom of the well. This practice did not work too well in the loose, unconsolidated formations of the Louisiana and Texas Gulf Coast. As a result new completion techniques utilizing screen or perforated pipe were developed.

More and more attention has been paid to well completions through the years. Huber, Allen, and Abendroth estimate that average completion costs are about 20 per cent of total cost. In 1950, they estimated that several hundred million dollars are spent annually in the United States on well completions.

Shooting

Detonating nitroglycerin in the bottom of the bore hole to increase production has been used in the industry since 1866. Optimum success has been obtained in consolidated sandstone, dolomite, and limestone reservoirs. Improvements through the years have consisted of improved transportation and reeling equipment, and the invention of solidified nitroglycerin which is much safer to handle than the liquid.

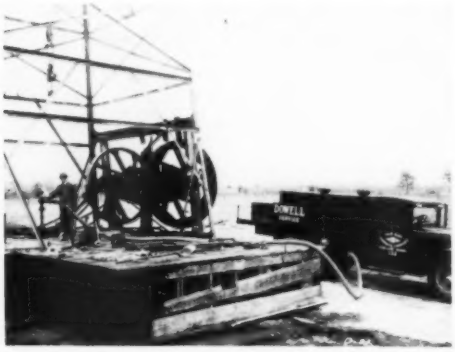
Acidization

As early as 1894 oil wells producing from limestone were treated with concentrated hydrochloric acid. The techniques used were not too satisfactory, though, and no general use was made of acid until the 1930's. In 1932, Dow Chemical Co. tested an inhibited acid (designed to retard the action of the acid on steel) in Greendale pool of Central Michigan with notable success. This process was the result of collaboration between Dow and Pure Oil Co. Growth of the process was rapid and in the same year acidization service was made available in the Southwest through treating stations at Breckenridge, Tex., Seminole, Okla., Newton, Kans., and Zwolle, La.

In recent years "mud acid" has been developed for the treatment of wells completed in formations other than limestone. First treatments were made in California in 1936, but applications were soon found in the Gulf Coast area of Texas and Louisiana. Commercial service was established in the Texas Gulf Coast early in 1939, and in Louisiana shortly thereafter.

Plastics

The use of plastics for completions and workovers is a relatively new development. The first application of plastics to a well for the purpose of reducing the water-oil ratio was made in 1938 in Rodessa field, Marion County, Texas. The use of plastics first spread to East Texas field and soon thereafter to other fields in the Mid-Continent and Gulf Coast. Plastics



Although acid was used as early as 1894 to increase the production of limestone wells, it was not until 1932 that the practice became widespread. In that year, Dow Chemical Co. and Pure Oil Co. successfully treated a well with inhibited acid and a few months later acidization service stations were set up throughout the Southwest.

are being used to regulate gas-oil ratios, and to consolidate loose sands in addition to the original use of treating water sands.

Perforating

Perforations can be made in oil-well pipe either before it is put in the hole or after. As early as 1914, screen and preperforated pipe were used in completion work.

The two general types of perforating equipment commonly used today in the Southwest for making holes in the pipe after it has been set in the hole are gun perforating and "jet" perforating.

Gun perforating, in which sharp-nosed steel bullets are used, was practiced in Texas for water-well completions as early as 1903. First recorded oil-field use was in 1933 in Montebello field of California.

Jet perforating has come into prominence during the post World War II period. This process utilizes the shaped-charge principle to perforate pipe. Shaped charges are the result of work by Prof. Charles E. Munroe in the 1880's in which he discovered that hollowing out the end of a high-explosive which is facing the object to be penetrated increases its effectiveness. Much of the initial work in adapting this principle to oil-field use was done in Texas.

Workovers

Workovers, or repair jobs to wells which have been previously completed, are usually performed to exclude gas or water from a producing well. During early days the most common method of shutting off gas was by using formation packers run on tubing. Methods for shutting off water included the use of formation packers and bottom plugs. Early bottom plus were made of a large variety of materials including wood, lead wool, and cement. Packers are still used today, but bottom plugs, squeeze-cementing, and plastics are used for most workover jobs.

Artificial Lift

IN the producing areas of Pennsylvania the pumping of wells by means of a walking beam, a string of sucker rods and a downhole pump were used in the first days of the industry. For power, the eastern producers initially used steam engines, but in the early 1900's the gas engine was coming into favor. It is reported that the first oil-well gas engines were put on the market in 1894. One manufacturer had even developed a convertible gas and steam cylinder. By 1912 electric power was being used for oil-well pumping in the Gulf Coast area.

Initially, one prime mover was used for each well to be pumped. By the early 1900's the "central power" had been developed to make it possible for one engine to pump more than one well.

Beam Pumping

Beam pumping, utilizing the same principles as the early-day units, is still popular in the Southwest. However, the comparatively crude installations have been replaced by well-engineered units of many types for various pumping problems.

A number of specialized types of mechanical devices, in addition to beam units, have been developed. These include: "long-stroke" pumping units; submergible, electrically driven, centrifugal pumps; hydraulically driven downhole pumps; and plunger lifts utilizing gas pressure.

Gas Lift

There is a second important general method of artificially lifting crude oil, in addition to mechanical lifting devices, as described above. This is gas or air lift. In gas lift, gas under pressure is put into the well, usually through the tubing-casing annulus, and enters the tub-

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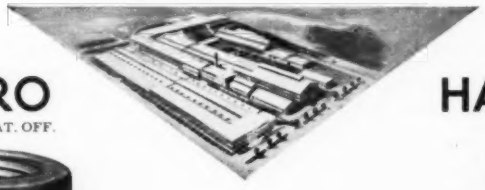

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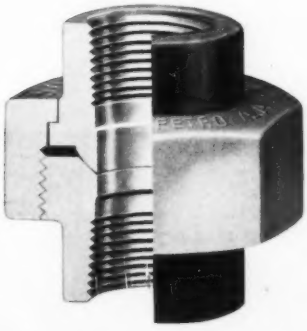

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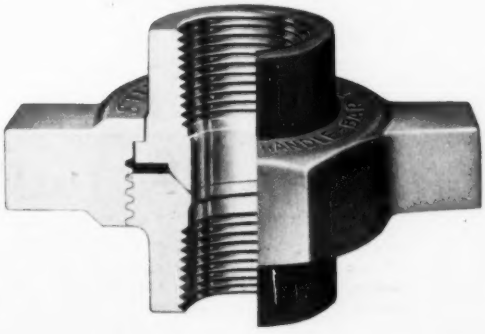

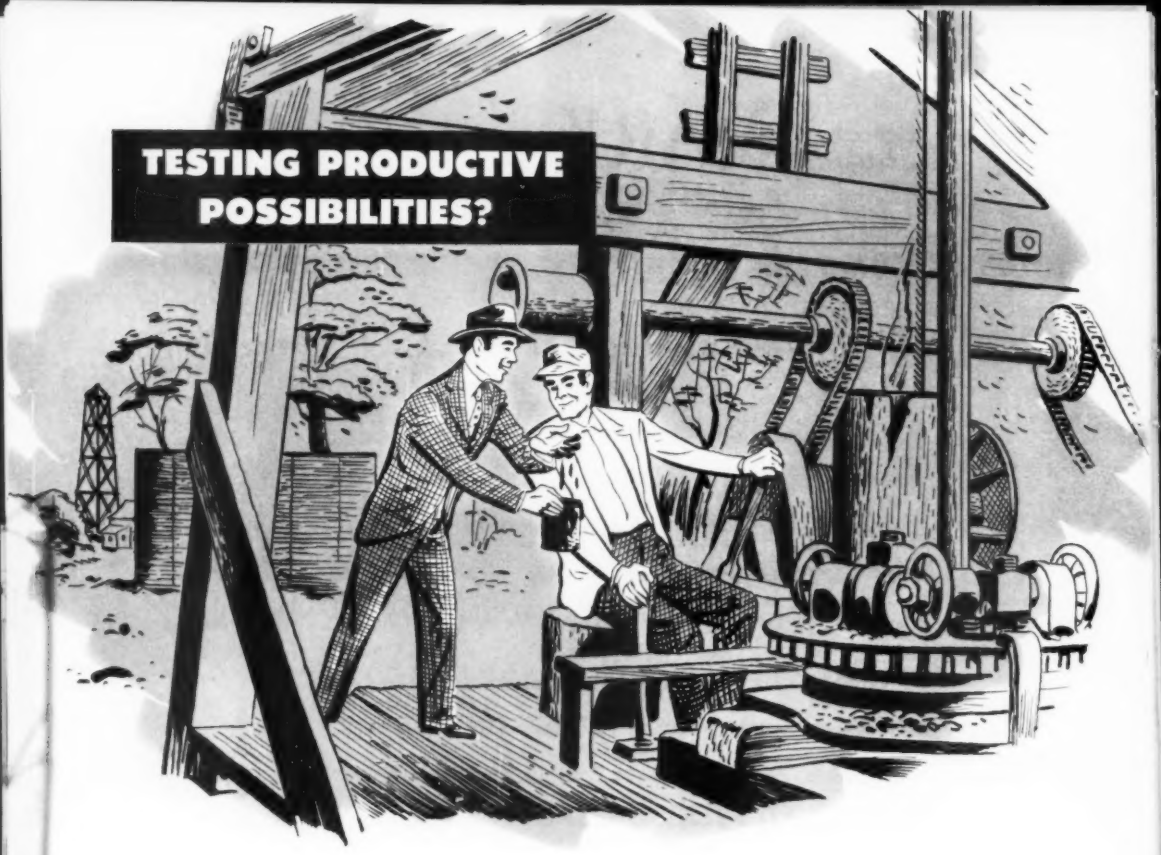

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ing through perforations or valves. The gas rising to the surface expands as its pressure drops thus lightening the oil column and allowing it to flow.

Air lift was used to pump water in northern Pennsylvania as early as 1846, and in oil wells during the 1860's. The method was carried into the Southwest as early as Spindletop in 1901. First widespread use of gas, in place of air, was in California in 1923. Today, gas lift is particularly popular in the coastal regions of Texas and Louisiana, but is used throughout the Southwest.

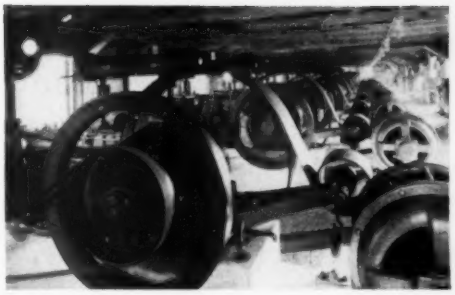
Earthen storage of crude oil on the lease was practiced in many areas during the early producing days of the Southwest. Both metal and wooden tanks are used today, but the steel are more popular. Wooden tanks are usually constructed of wood staves. Metal tanks are usually constructed of riveted sheet steel, iron, or galvanized iron. Bolted tanks are sometimes used for initial storage.

In some fields, notably East Texas, automatic equipment in recent years has simplified lease operations. On one East Texas lease, oil from 31 wells automatically flows into a single, central tank battery. As the individual storage tanks fill up, a valve automatically switches the oil flow into the next tank. A system of clocks and switches in the pumper's control house permits the wells to produce their daily allowable on any desired schedule.

Secondary Recovery

THE use of compressed air, vacuum gas, steam, or water to increase the recovery of oil is almost as old as the commercial production of oil in the United States. These methods were first used in the birthplace of the industry—Pennsylvania. Vacuum was used in the Triumph pool of Pennsylvania in 1869. James D. Dinsmoor pioneered gas injection on the Benton farm, Venango County, Pennsylvania, in 1890. Water flooding entered the picture around the turn of the century in the Bradford, Pennsylvania, field. This secondary-recovery method was first discovered, it is believed, by the accidental flooding of oil sands caused by failure to properly exclude water from wells.

Secondary recovery made its appearance in the Southwest in 1917. In that year, gas-repressuring operations were started in Nowata County, Oklahoma. Honors for the first water flood in the Southwest also go to Nowata County. Unsystematic floods were commenced in 1931, and in 1934 a systematic operation was undertaken in the Bartlesville sand.



Air lift was widely practiced during the Greater Seminole boom of the 1920's to increase the production of the wells. This plant contained 14 Worthington compressors each driven by a 75-hp. General Electric motor.

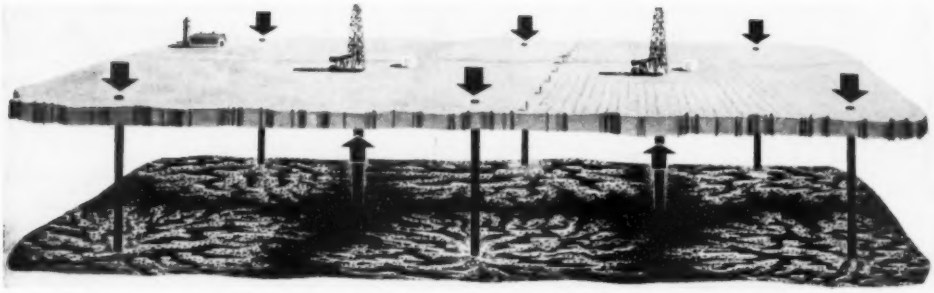
Cycling

A relatively new secondary-recovery practice is that of cycling. It is used in gas-condensate reservoirs, without an active water drive, to produce the oil. Gas produced with the oil is processed in an extraction plant to strip it of its liquid hydrocarbons. The "dry" gas is then pumped into the reservoir, thus maintaining reservoir pressure at a high level. The dry gas also flushes more oil to the producing well bores. One of the first cycling operations was undertaken in Cotton Valley field of Webster Parish, Louisiana, in 1940.

There have been several attempts to mine petroleum in the United States. Some of these projects were carried on in the Southwest—Miami County, Kansas; Richards, Mo.; Wichita Falls, Tex.; and Nacogdoches, Tex. The system used has been to drill a number of horizontal holes out from a central shaft and drain the oil from the sand into the central shaft. No

DIFFICULT WATER FLOOD

ONE of the most difficult water floods which have been attempted in the Southwest has been that in the Pettit lime reservoirs of the Haynesville, Louisiana, field which was discovered in 1941. This field is one of the first where an attempt was made to flood a very tight (20 md.) thin limestone at a considerable depth (5,000 ft.). A combination gas-repressuring and water-flooding project is being carried on. Of further interest is the fact that the flood is being carried on with 80-acre spacing of wells, with a line-drive type of flood. This wide spacing is unique even today in water-flood operations. Present estimates are that ultimate recovery will be approximately double the recovery expected under the original solution gas drive.



This schematic drawing illustrates the five-spot method of water flooding oil fields. Four water input wells at the corners of a square are used to force oil into the bore hole of a producing well in the center of the square.

attempts at mining have been commercially successful to date.

Experiments are being conducted to determine the practicability of using bacteria to aid in the recovery of oil. Results indicate that certain bacteria may release crude oil from oil-bearing sands.

Compact Survey

A survey completed in 1950 by the Interstate Oil Compact Commission contained these highlights on secondary-recovery activity in the Southwest.

Kansas: There is an increasing tendency to unitize large blocks for development. Oil recovery from secondary projects in Kansas in 1948 was estimated to be in excess of 5,000,000 bbl.

Texas: Gas injection has been practiced for some time on a wide scale and water flooding has been used in only a few cases, but there are an increasing number of projects planned to utilize water injection. Water flooding until recently has been confined principally to the shallow North Central Texas area.

Arkansas: In Arkansas a number of projects of considerable size have been in operation for several years. Recently inaugurated projects include Wesson, Lisbon, and Hillsboro.

Louisiana: There are 22 projects utilizing injection, including several water injection projects on a field-wide basis.

Oklahoma: With the formation of the North Burbank Water Flood unit, which will be the largest, the production from secondary-recovery projects in Oklahoma will get a tremendous boost. Oklahoma may become the largest secondary-recovery producer in the United States within a short time.

New Mexico: The Rhodes Unit, operated by the El Paso Natural Gas Co., is an outstanding example of a unit created for natural gas storage.

Mississippi: Cranfield field was unitized in 1947 and Brookhaven in 1948. Both are gas-condensate fields.

Pressure maintenance.—This field practice, first commenced only a few years ago, is one of the big "money makers" of the industry. In brief, application of pressure maintenance gets more oil into the tanks via increased ultimate recovery. Increases may run 50 per cent or more. These projects also have A-1 ratings as conservation measures. In the State of Texas alone, it has been estimated that 3 billion barrels of additional oil will be recovered by secondary means, which otherwise would be lost. Pressure maintenance usually also provides investment and operating economies by permitting wider well spacing, prolonging natural flow of wells, conserving associated natural gas.

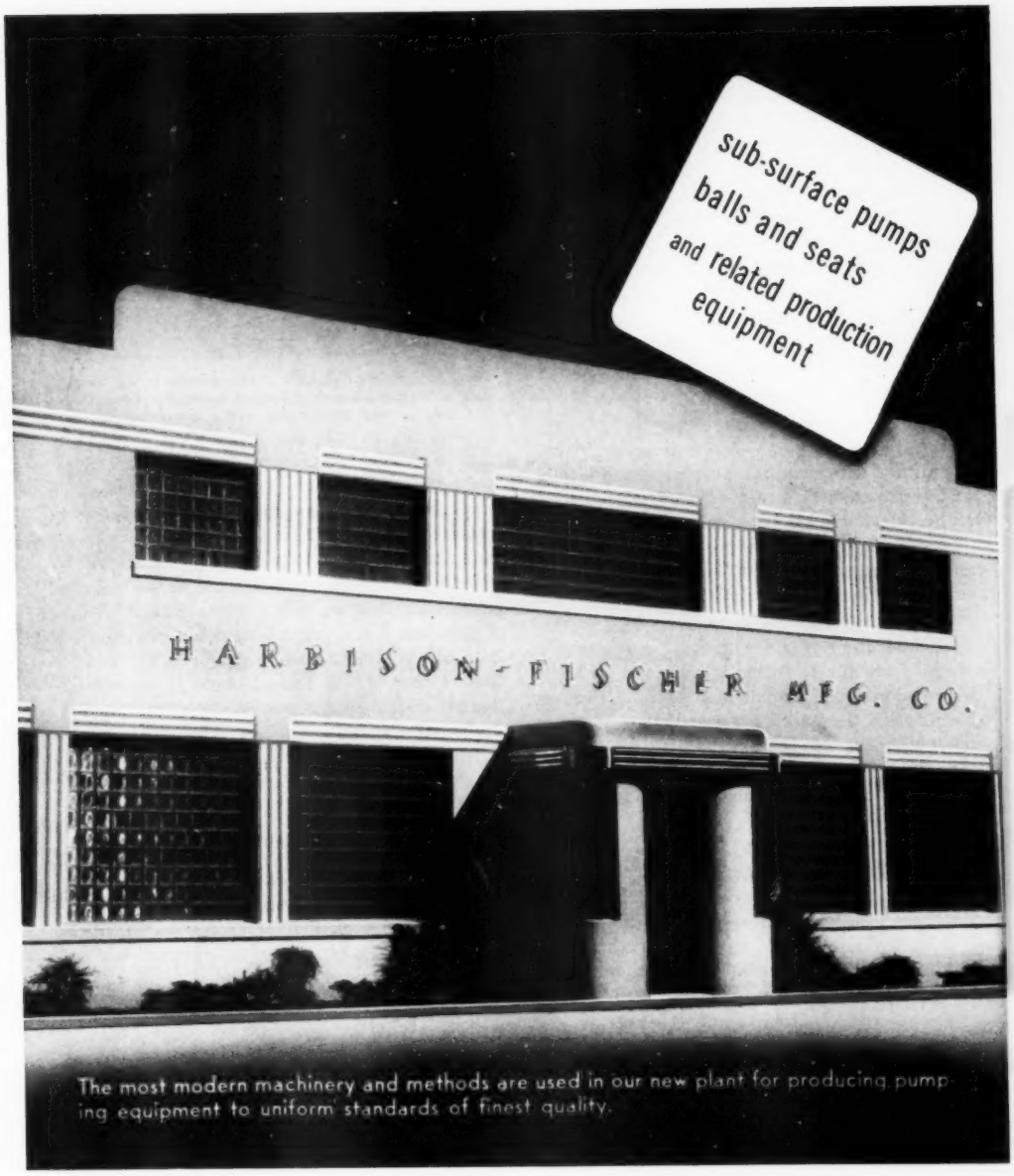
Field Processing

THROUGH the years there has been growing realization among petroleum engineers that they have a unit of work organization classified broadly under "Field Processing Operations." Some phases of these operations date back to 1910 but progress has been particularly rapid since 1930.

Field-process operations as outlined briefly are presented in their approximate sequence of operation as the oil and gas proceeds from the well head.

Treating and processing.—Important increases to the salable volume and gravity rating of crude oil have been effected by thorough and careful treating and separation of the crude from gas and/or water. Maintenance and secondary treating jobs are reduced or eliminated by using proper initial treating methods. In this phase of the processing such equipment as separators, heaters, heater-treaters, free-water knockouts, and allied units are used.

After the oil has been brought to the surface, it is necessary to remove gas, water and sand from it and store it on the lease. From the well head the oil is normally run through an oil and gas separator. If it contains salt water, it is next run into a settling tank. If the oil-water mixture is emulsified it may also be necessary to treat it with heat, chemicals, electricity, centrifugal force, or filtration. The clean oil is next put into the stock tanks to await delivery to the pipe line.



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An early gas separator in the Southwest consisted simply of a joint of casing in a vertical position. The oil-gas mixture entered through a smaller pipe at the top of the casing. Gas was withdrawn through another pipe at the top, and the oil escaped through an outlet at the bottom. This crude equipment has now been replaced by many well-engineered gas separators of various types.

For high-pressure wells, "stage separation" has been evolved wherein the oil is passed through two or three separators arranged in series, with the pressure successively lower in each separator. Among other things, this procedure makes possible a minimum loss in gravity of the oil thus giving the producer a higher price for the oil.

Crude stabilization.—A continuance of treating aimed, however, at keeping gravity high and constant with a minimum of losses, is the principal motive behind this field operation. The stabilization process provides an important means toward obtaining salable crude oil for transportation to the pipe line by controlled evaporation of light ends.

Dehydration of gas.—Freezing and plugging of gas lines due to formation of solid hydrates led to adoption of dehydration as a unit process in the field. Research has resulted in a better understanding of the mechanism of hydrate formation, adoption of a standard dew-point apparatus, and development of commercial dehydration methods.

Adsorption with solid desiccants is carried out in a fixed-bed process using two or more towers operating alternately in dehydration and regeneration cycles. Use of diethylene glycol (DEG) as a liquid adsorption process will handle large volumes of gas at high operating pressure.

Desulfurization plants.—Desulfurization of natural gas with aqueous ethanolamine solutions by countercurrent contact and chemical reaction in an absorber, followed by regeneration of the solution in a stripper column, is ordinarily carried out by central gas-purification plants. Small automatic units are gas-fired and air-cooled, featuring portability and quick erection, and are used at single gas wells. Equipped with automatic shutdown to prevent discharge of sour gas, they permit discharge of purified gas directly into main transmission lines. Drilling-rig and compressor fuel gas also may be treated with these units. Another recent practice is to combine desulfurization by amine with dehydration using diethylene glycol.

Special-products plants.—Recovery of special products via field-processing operations involves a wide variety of technology and equipment. Such plants employ processing apparatus identical with that found in petroleum refining and in many nonpetroleum chemical plants. Production from special-product plants includes elementary sulfur, solid carbon dioxide or dry ice, carbon black, and a long list of oxygenation and other hydrocarbon compounds, to name a few. Carbon-black manufacture is one of the earlier field operations employing unit processing methods. Removing and recovering sulfur from natural gas is now an important operation in some gas-producing areas.

Elmer Decker (Martin-Decker Corp.), pioneer in the development of weight indicator equipment, measuring the pull on a pumping jack line in 1929 with a tension indicator.

Unitization

ONE of the most effective conservation measures which has been evolved in the oil industry has been that of unitization. Unitization is the pooling of the interests of the operators, and in some cases the royalty owners, in a field (or portion thereof) and putting one central authority in charge of producing the field.

Van pool, in Van Zandt County, Texas, is generally recognized as the nation's first unit operation. The year of its discovery—1929—the five companies holding leases in Van (Pure, Humble, Shell, Texas, and Sun) agreed to have one firm, Pure, handle the operation of the entire pool. On October 14, 1949, Van field after 20 years of successful operation had produced more than 200,000,000 bbl. of oil.

Oklahoma Pioneers

In 1946, Oklahoma pioneered in conservation with a law requiring compulsory unitization in fields where operators controlling at least 85 per cent of the field concur. First field

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of the Spindletop discovery
...and congratulates
THE OIL AND GAS JOURNAL
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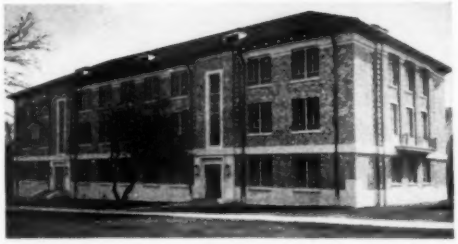
unitized under this law was the huge 30,000-acre West Edmond field where Sohio Petroleum Co. took over the unit operation on October 1, 1947.

The largest *voluntary* unit operation in the United States is in the Old Ocean field of Brazoria and Matagorda counties, Texas Gulf Coast. With J. S. Abercrombie Co. as operator, the unit took over the field on August 1, 1948.

Reservoir Engineering

THE relatively new art of reservoir engineering has had considerable influence on production practices and equipment. All major companies, and many smaller ones, now have full-time engineers to study the behavior and characteristics of oil and gas reservoirs. Such terms as porosity, connate water, and permeability are becoming a part of the every-day language of most production men.

Reservoir behavior is being carefully studied by means of highly involved mathematics and intricate, electronic devices. In 1946, Carter Oil Co. devised an electronic instrument known as the "oil pool analyzer" which can predict the production history of certain types of fields 25 years or more into the future.



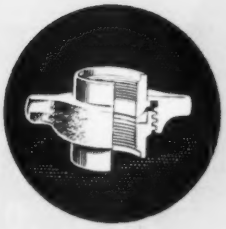
The oil and gas industries have encouraged the establishment of petroleum courses at universities located in the Southwest. In many cases associations have used the facilities of universities and colleges to present courses of study for their membership. Private companies and associations have also provided scholarships and fellowships for students doing special work connected with petroleum activities. The first petroleum courses were offered at Missouri School of Mines, Rolla. The following schools offer petroleum engineering degrees: University of Kansas, Louisiana State University, University of Oklahoma, Texas A. & M. College, Texas A. & I., University of Texas, University of Tulsa, and Texas Technological College. View shows main building, Petroleum Engineering School, University of Texas.

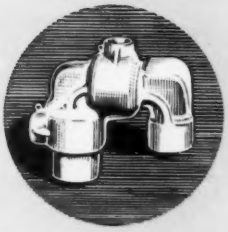
Fifty Years of Oil and Gas Conservation

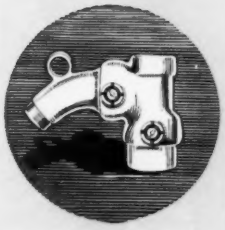
THERE have been three primal forces at work in the areas of legislation, administration, and judicial action to create the concept of conservation law. These have been (1) the growth and enlargement of the idea inherent in the waste-prevention theory, (2) the gradual shift in traditional American legal processes from a system based on courts and court decisions to a system based in part on the administrative agency and administrative control, and (3) the scientific formulation of a body of accurate physical principles which relate to the operation of the petroleum reservoir and the utilization of its elemental drives. There is a fourth at work—the Interstate Compact to Conserve Oil and Gas and its administrative arm, the Interstate Oil Compact Commission.

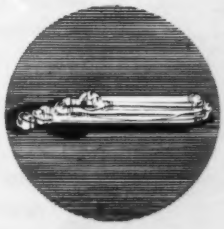
The steps in the development of waste-prevention laws do not lend themselves readily to dogmatic systematization. Categorizations must be broad; there will be interblending in instances, yet there are certain pegs upon which cencepts may be hung to serve as reference points: (1) the control and prevention of underground and aboveground physical waste, (2) the combination of the physical waste program with the first stirrings of economic waste, and (3) the rise to preeminence of economic waste.

As the discovery of oil and gas moved from the East to the Mid-Continent at the turn of the century, each oil state passed measures to control physical waste. Modified from time to time as experience and increased knowledge dictated, these statutes were designed to prevent underground and aboveground waste by: (1) requiring casing programs to halt subsurface migration of fluids and gases with attendant pollution of fluids, gases, and formations, (2) preventing drowning of producing horizons by surface or subsurface waters, (3) halting waste of reservoir energy, (4) stopping blowing of gas from gas wells into the air, (5) barring utilization of natural gas in flambeaus or jumbo burners, (6) outlawing manufacture of carbon black from natural gas, (7) forbidding surface pollution by oil, gas, or brines destructive of crops, plants, animals, and the land, (8) insuring proper abandonment of well bores, (9) halting wasteful destruction of natural gas in wild or burning wells, and (10) creating administrative agencies to supplant self-executing statutes.









50 YEARS OF PROGRESS

The 50 years that have elapsed since Spindletop will go down in history as an era of technological and mechanical development by the Petroleum Industry . . . a record unmatched by any other industry anywhere in the world. CHIKSAN and WECO are proud indeed of the recognition accorded to CHIKSAN and WECO Products during this important era . . . glad of the opportunity to contribute of their engineering and manufacturing skills to the end that constant progress shall be maintained. Therefore, on this 50th Anniversary of Spindletop, we pledge ourselves to a continued program of development in step with the steady progress that always has . . . and always will . . . keep the Petroleum Industry forging ahead to still greater achievements.

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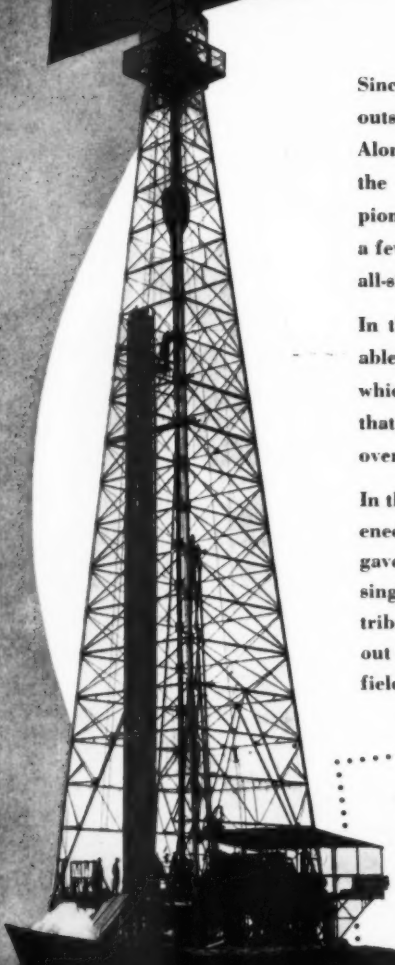

Since its founding 54 years ago, Parkersburg has made many outstanding contributions to the progress of rotary drilling. Along about the middle of the century, almost coincidental with the invention of the rotary drilling method, Parkersburg pioneered and developed the portable drilling derrick . . . and a few years later became the leader in the development of today's all-steel heavy duty drilling derrick.

In the early 20's Parkersburg developed the first all-steel portable substructures, engine support and pipe rack . . . all of which are an indispendable part of every modern rotary outfit, that have saved operators thousands of dollars in drilling time over the years.

In the early 30's, when lack of adequate drawworks brakes threatened to halt all attempts to drill below 8000 feet, Parkersburg gave the industry the Hydromatic Brake. Probably no other single new equipment development of the past 20 years has contributed so much to the progress of deep well drilling. For without the Hydromatic it is almost certain that none of today's deeper fields could have been discovered.

With over 54 years service to the industry behind us, Parkersburg looks to the future . . . full of confidence that Parkersburg developments still to come will continue to help with the history of rotary drilling and provide substantial aid to its progress.

1951

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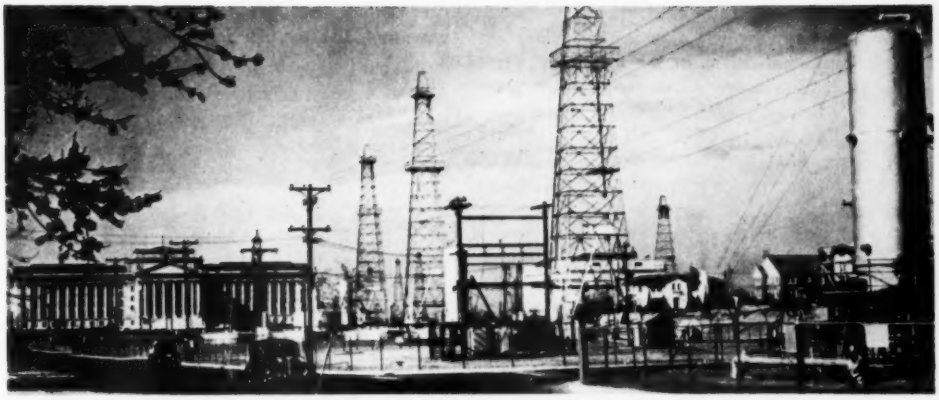


Outstanding has been the work of the state bodies in bringing about the application of conservation regulations. The need for the controls was brought home to the Oklahoma Corporation Commission when the development of the Oklahoma City field in the early thirties was brought to the capitol with wells, one of which through directional controls found oil at the field depth under the building.

But by 1909 demands were being made upon the legislative ingenuity to curb abuses which caused waste in producing. One response was that of the Oklahoma Legislature in its passage of an oil common purchaser law making common carriers of crude engaged in oil buying into common purchasers. Should these purchasers be unable to take all available oil, ratable purchase was prescribed without discrimination in price, quality, or ownership.

Four years later Oklahoma made conservancy history by passing two gas-control laws —the first made common purchasers of natural gas out of those transporting gas within the state and established ratable purchases as in the 1909 oil law; the second provided for ratable production of natural gas from common sources of supply. Transporters of gas in the latter act must take ratably upon agreed terms between the owner and taker; should there be no agreement, then the price must be fixed by the Oklahoma Corporation Commission.

Tentative steps away from the ordinary physical waste program came with the 1915 enactment in Oklahoma of two statutes—one for oil and one for gas—that remained pioneering examples into the thirties. The oil measure introduced for the first time the theory of market demand through a comprehensive definition of waste. The statute made illegal the production of oil in a manner constituting waste; oil produced in excess of market demand was waste. Whenever full production of oil was possible only under wasteful conditions, the Oklahoma Corporation Commission was authorized to regulate common oil sources of supply to prevent unfair or inequitable taking. A system of administrative regulation, of administrative controls, and of judicial review was provided. The gas-conservation law, passed a month and a half after the oil measure, barred all known forms of gas waste, provided for ratable production when market demand was exceeded, and in general followed the administrative provisions of the oil law. An added feature made common purchasers out of those engaged in purchasing gas and required common sources of supply to be produced ratably. The Oklahoma Corporation Commission proceeded to put into operation the authority contained in these acts, and June 5, 1915, commenced the regulation of oil production in Headlton field; later in the year rules were prepared after hearings to halt gas waste.

The market-demand technique in conservation law lay quiescent until 1918 when the Louisiana Legislature established the foundation for control of natural-gas production where full production exceeded demand. The Oil Common Purchaser Act of 1920 made it the duty of Louisiana buyers to take oil proportionately during times of oversupply.

The year 1927 began the period of continuous production control in Oklahoma which operates today. Discovery of new areas of flush production within Oklahoma, the opening of prolific fields in other areas located strategically from a marketing standpoint, and a potential production that exceeded market demand, paved the way for the adoption in 1928 of the first state-wide order restricting production of oil.

The deepening economic crisis at the end of

1929 ushered in a decade of strain and turmoil in the industry; a decade in which many of the most vital measures in the law of oil and gas conservation were developed, tested, and if unable to meet judicial scrutiny, discarded.

Progress in the law of oil and gas conservation during 1930 to 1940 is readily seen by setting out the major activities which took place year by year.

1930

The courts of Oklahoma sustained the 1915 oil act in *Julian Oil & Gas Royalty Co. v. Capshaw*, 145 Okla. 237, 292 P. 841. The Texas Legislature enacted an oil common-purchaser statute.

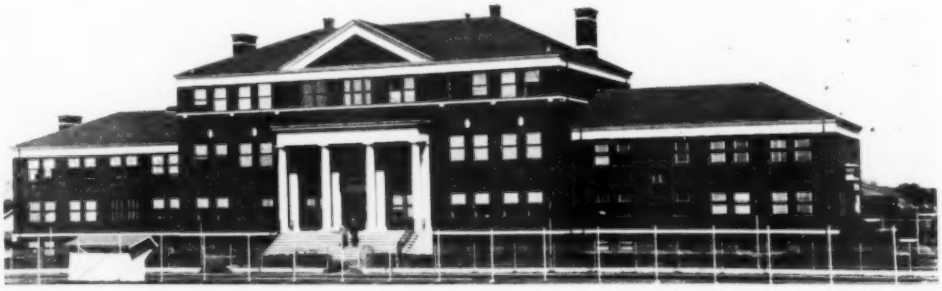
1931

The Kansas Legislature adopted a measure limiting production of oil where full production constituted waste, prohibited waste, and provided for ratable taking. A conference called by Gov. William H. Murray of Oklahoma at Fort Worth February 28 and March 1 formed the Oil States Advisory Committee; at its first meeting March 9 representatives were present from Oklahoma, California, Kansas, Wyoming, Louisiana, Arkansas, and Texas. The Texas Legislature adopted the Marginal Well Act which assigned wells of stated depths a maximum daily production schedule. The legislature passed the Antimarket Demand Act under the impetus of the decision in *McMillan v. Railroad Commission of Texas*, 51 F. 2d 400, where the court expressed its opinion that the orders of the commission in East Texas field were void because they were based upon market demand and economic waste contrary to law. The new statute barred known physical waste, stated economic waste was not physical wastage, and denied the commission power to limit production to market demand, or to consider any waste other than physical waste. At this session the oil common-purchaser statute was amended to include natural gas.

Martial law was declared in Oklahoma August 4 and in Texas August 17, and troops were sent to close down production in Oklahoma City and East Texas fields. The day following the Oklahoma declaration of martial law a three-judge federal court sitting at Guthrie in the case of *Champlin Refining Co. v. Corporation Commission*, 51 F. 2d 823, held the 1915 Oklahoma oil law valid.

1932

Rugged is descriptive of the course of conservation in Texas during 1932. The United States Supreme Court in deciding *Champlin Refining Co. v. Corporation Commission*, 286 U. S. 210, 76 L ed. 1062, established the validity of the 1915 Oklahoma oil act; it held the limitation of production to market demand a proper means of preventing waste. In spite of this the lower federal court in Texas in *Peoples Petroleum Co. v. Sterling*, 60 F. 2d 1041, again enjoined enforcement of the orders of the Railroad Commission on the ground that curtailment limited to market demand contravened the express command of the statute. Apparently satisfied the court meant what it said about market demand, the Texas Legislature enacted the Market Demand Act which dropped the inhibition against economic waste and the limitation of production to market demand. It specifically defined waste as (among other things) the production of crude oil in excess of reasonable market demand. In June 1932 the Gas Common Purchaser Act of 1931 was voided in *Texoma Natural Gas Co. v. Railroad Commission*, 59 F. 2d 750; the commission's order of 1932 closing Panhandle field's sweet-gas area, and restricting production in other portions of the field was invalidated in



The Bureau of Mines cooperating with operators and the state conservation bodies has had an important part in furthering petroleum conservation. The Petroleum Experiment Station, shown above, was built at Bartlesville, Okla., in 1937. The original station was built in 1918. Work of the B. of M. which includes field offices at Dallas and Wichita Falls, Tex., covers all phases of oil and gas activity.

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December in *Texoma Natural Gas Co. v. Railroad Commission*, 2 F. Supp. 168. Although the called session of the legislature adjourned before the latter case was decided, a section was included in the Market Demand Act relative to natural gas and authorizing the commission to determine reasonable market demand producible without waste from a common source of supply of gas, and to apportion and allocate that demand.

1933

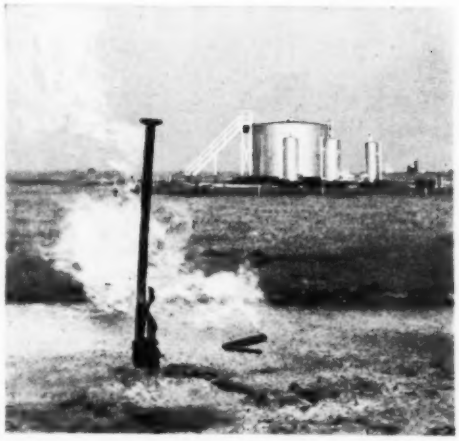
Two states adopted comprehensive conservation statutes—Oklahoma and Kansas. One of those amusing mishaps occurred in Kansas when the legislature in creating the Corporation Commission of Kansas neglected to give it power to control petroleum. A further session was necessary. Two important court decisions came from the Oklahoma Supreme Court—*H. F. Wilcox Oil & Gas Co. v. State*, 162 Okla. 89, 19 P. 2d 347, reminded the commission it must issue production-control orders separately for each common source of supply, while *Sterling Refining Co. v. Walker*, 165 Okla. 45, 25 P. 2d 312, sustained the validity of the 1933 statute. In Texas the federal court voided the Railroad Commission's order based on the gas-market-demand section in *Canadian River Gas Co. v. Terrell*, 4 F. Supp. 222, saying that the agency had no authority to regulate production except to prevent physical waste; no evidence was adduced showing such waste.

1934

The case of *Panama Refining Co. v. Ryan*, 5 F. Supp. 639, started on its way in 1934; the next year the Supreme Court of the United States struck out the hot-oil sections of the NIRA. Congress authorized the creation of the Cole Committee to conduct investigations in the industry. In the closing months of the year the negotiations began which led to the formation of the Interstate Compact to Conserve Oil and Gas.

1935

This was the outstanding year of the decade for oil and gas conservation. New Mexico adopted its justly famous conservation statute. Oklahoma demonstrating a new trend in thinking, changed all references to proration to read conservation in its prior law, modernized the 1933 act, and for the first time authorized the creation of well spacing and drilling units in an oil-common source of supply. Texas amended its definition of waste, extended the time limit of its conservation law, passed the Transportation Act of 1935 to regulate transportation of oil and products, and enacted a comprehensive gas regulatory measure including allocation of production where full production exceeded market demand. This measure was the subject of court attack in *Texas Panhandle Gas Co. v. Thompson*, 12 F. Supp. 462, which resulted in an injunction against the commission's order allocating production in Panhandle field.



Steady progress in the field of conservation has almost eliminated gas flares such as this.

August 9, 1935, President Franklin D. Roosevelt transmitted to the Seventy-fourth Congress a copy of the Interstate Compact to Conserve Oil and Gas as ratified by New Mexico, Oklahoma, Kansas, Colorado, Texas, and Illinois, thus marking a fitting climax to the signing of the agreement February 16, 1935. Federal assent to the compact was received August 27 and with the signature of the President the compacting states organized the Interstate Oil Compact Commission.

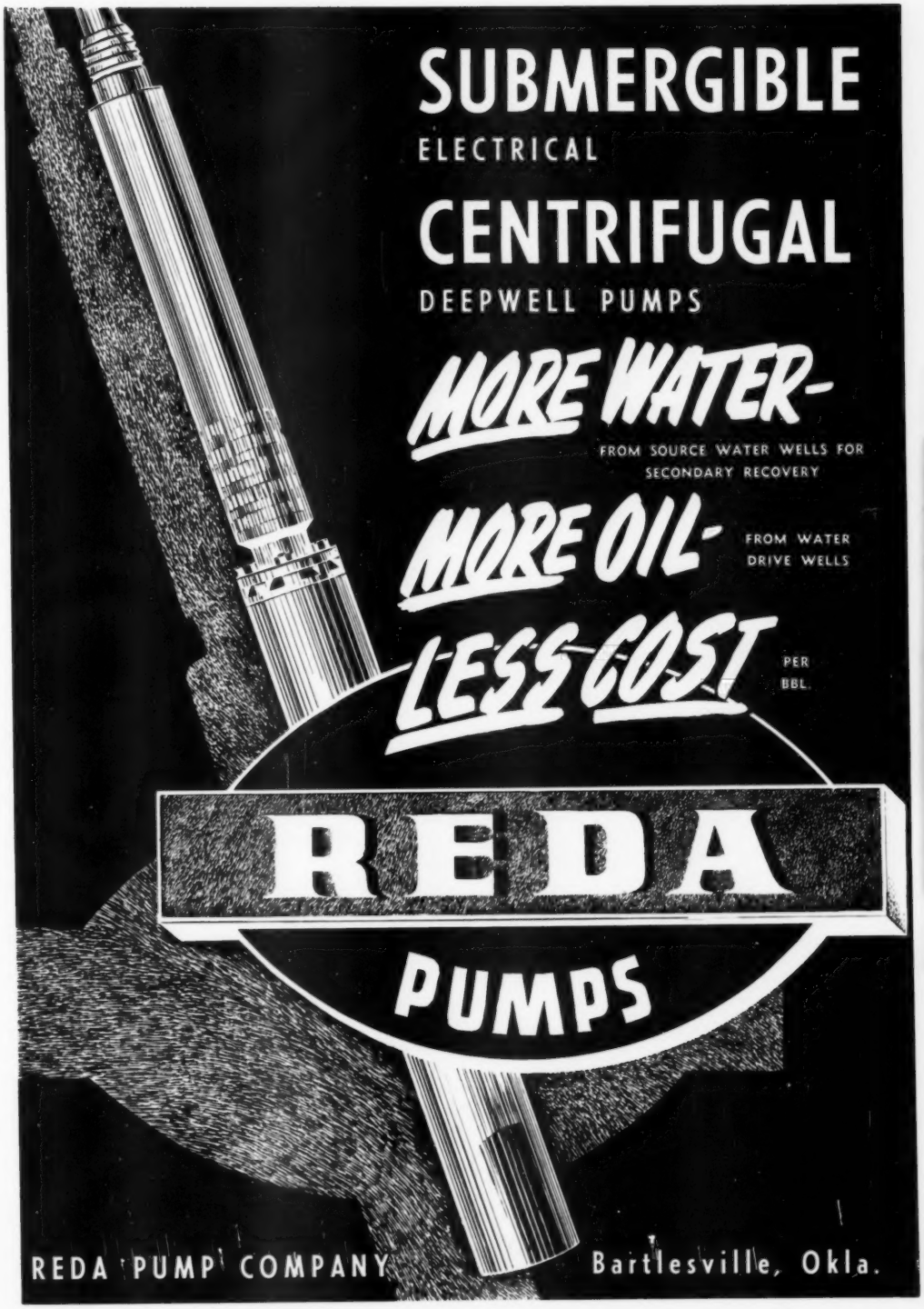
With the final disposition of Section Nine in the *Panama Case*, it became important to supplement Section Nine c of the NIRA to prevent interstate transportation of hot oil. Congress enacted the Connally Act February 22, 1935, replacing the section and thus aided the states in their fight against illegally produced oil.

1936

Louisiana adopted a comprehensive statute to conserve oil, sulfur, and natural gas. Waste, including that caused by production in excess of market demand, was prohibited. The Connally Act was sustained in *Griswold v. President of the United States*, 82 F. 2d 922.

1938

Congress passed the Natural Gas Act of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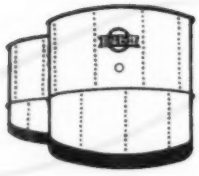

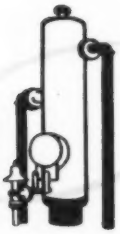

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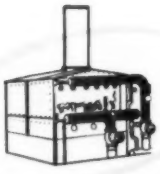

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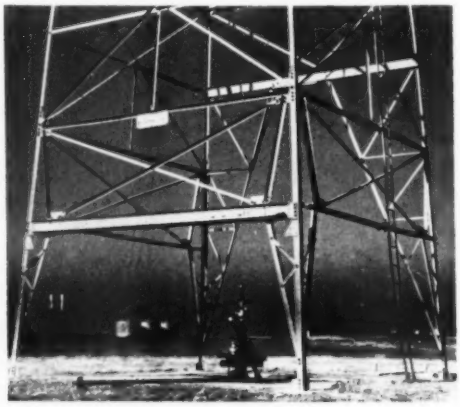
1938. The Oklahoma Well Spacing Act pooling lessors' royalty in a unit was sustained in *Patterson v. Stanolind Oil & Gas Co.*, 182 Okla. 155, 77 P. 2d 83, appeal dismissed 305 U. S. 376; this decision resolved any doubts royalty owners might not be required to share acreagewise the one-eighth landowners' production. *Henderson v. Terrell*, 24 F. Supp. 147, marked a change in Texas—a federal court approved of a gas law in sustaining the sour-gas law of 1937.

1939

This was the year of conservation acts—Alabama, Arkansas' great Act 105 widely copied in many jurisdictions, the Atkinson bill in California defeated in the November referendum, an oil measure in Kansas, and a new oil act in Michigan which outlawed market waste among other kinds of waste.



This christmas tree is on the discovery well of Van field, Van Zandt County, Texas, which was completed on October 13, 1929. The field is generally recognized as the nation's first unit operation. Within 2 weeks after the discovery well was brought in, the five companies holding leases in the area had agreed to a unit plan of operation.

Croxton v. State, 186 Okla. 249, 97 P. 2d 11, upheld those parts of the Oklahoma Well Spacing Act of 1935 that limited the power of the Oklahoma Corporation Commission to act except with permission of at least 80 per cent of the lessees in number and acreage. The court held it immaterial that a well might not recover the oil from beneath its own spacing unit so long as all wells had an equal opportunity to recover a fair share of the oil in the common source of supply. The Railroad Commission of Texas suffered once again from having its proration orders set aside in *Rowan & Nichols Oil Co. v. Railroad Commission*, 28 F. Supp. 131.

Four judicial decisions and the enactment in Louisiana of Act 157 of 1940 began the next decade. Two Kansas cases, *State Corporation Commission of Kansas v. Wall*, 113 F. 2d 887, and *Bay Petroleum Co. v. Corporation Commission*, 36 F. Supp. 66 promulgated basic conservation principles.

Beginning with the forties, legislatures were willing to enact statutes to control economic wastes even at the cost of a fracture in the traditional American concept of private-property law. Not all of the ideas advanced were new; many had been advocated for 30 years. What was new in the forties was the ability of the petroleum engineer to demonstrate the validity of his work in reservoir control and drives, against a background of war, and our discernible need for conservation of natural resources cooperated to improve waste prevention.

Three legislative fields indicative of the changes in conservation were (1) spacing and drilling units, (2) increased conservation of natural gas, and (3) compulsory unit operation of fields.

When Louisiana passed Act 157 of 1940 it adopted an unlimited definition of waste giving the commissioner of conservation wide powers to order the establishment of spacing and compulsory pooling of separately owned tracts into a unit. The constitutional position of the enactment is sound.

Ten years after the adoption of the 1935 well-spacing law in Oklahoma, that act underwent revision. The pooling of the lessees' interests was made compulsory but not self-executing, the statute was enlarged to include gas and distillate fields, and a consent percentage clause was written in for units larger than 10 acres. By 1947 the percentage requirements had become onerous and the Oklahoma Corporation Commission was given absolute authority over the spacing of oil, gas, and distillate-common sources of supply, except that units of more than 40 acres in area might not be formed if the oil-common source of supply was less than 9,900 ft. in depth.

The problem of gas conservation has been attacked on three fronts: (1) by orders of regulatory agencies which fix a minimum price at which gas may be sold in the field (thus enhancing its contract value to reach a point more nearly in line with actual value, thereby reducing uneconomic uses and making it economically feasible to produce and market gas); (2) by requiring that oil wells be closed in until the gas there produced is devoted to legal purposes; and (3) by the continued evolu-

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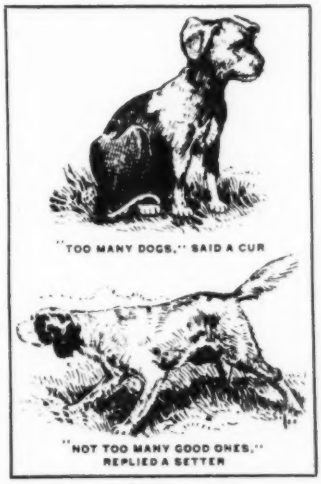

This Robinson Packer ad appeared in The Oil and Gas Journal September 12, 1912, advertising red packers and other specialized tools.

We Build Packers for Every Known Purpose

Do you want setters? Then get the red packers bearing our trade-mark and you will make no mistake.

Robinson Packer Company still produces the same thoroughbred setters for the following oil field installations:

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Pumping Wells
Repressuring
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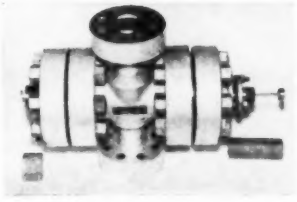
Packing Gas Wells
Packing off-water and water sands
Repairing leaky casing

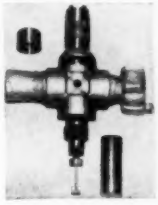
ROBINSON PACKER COMPANY

Coffeyville, Kan. — Tulsa



The Roberts automatic shut off, 10,000 lbs. working pressure valve is ready and meeting the need of greater surface installation strength due to the higher pressures found in the search for gas to meet our expanding markets. Any setting of high and low to protect your equipment, personnel, well and reservoir can be had and change of setting is made in the field without any shutdown of producing time.

Placed either up or downstream from the choke to meet your various needs. In the upstream head any combination of trip settings can be had such as one pressure from well to heater and another from heater to hydracepter by a pilot line led back to the valve head. These settings can be either high or low or both from any point downstream of the step down in pressure and any pressure setting can be obtained as desired in the field by your field men.



The versatility of the connections to be had on the Roberts automatic shut off valve can meet the need of any installation, new or old. Optional tapped hole in the cross for bleeder valve or gauge can save a costly connection.

What is your pressure problem? — whether oil, gas or both, the Roberts automatic shut off valve is ready with its versatile ability to protect your lines and equipment from well to storage.

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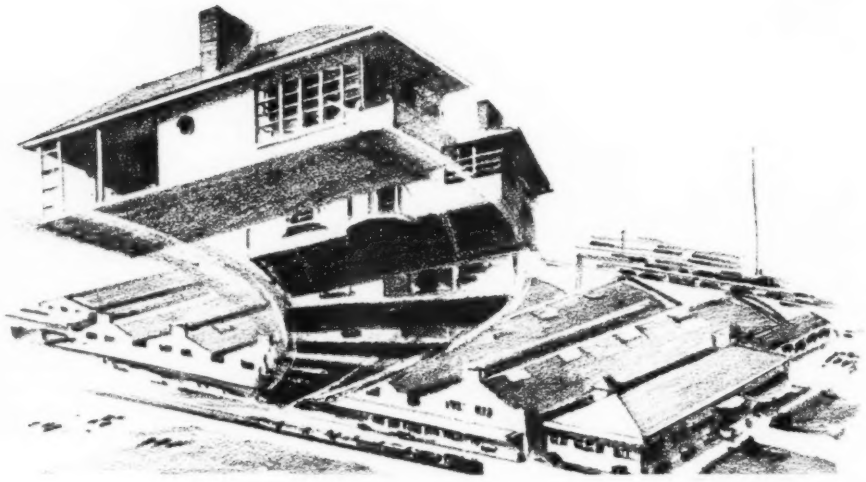
Path of Progress

Cities and states, individuals and industries have grown great following the path of progress marked by the development of the oil industry in the Southwest since Spindletop.

We are proud to count ourselves members of that great industry. For, since 1917, we have helped the petroleum industry build homes for its workers from Mississippi to Utah — from Venezuela to Illinois.

For over one-quarter century, we have applied the principles of American mass production to the building of Houston HOMES.



Prefabricated homes — like automobiles, radios and refrigerators — have improved standards through our pioneering in mass production.

Oil field, pipe line and refining communities and industrial townsites up and down the United States and Latin America have grown with our homes. Our architectural and engineering service has achieved attractive individual design, sturdy construction, and simplified erection.

Through this service, we have contributed to — and have progressed with — the oil industry, which is celebrating its Golden Anniversary in the Southwest, marking 50 years of progress since Spindletop.

PREFABRICATED HOME MANUFACTURERS' INSTITUTE phmi

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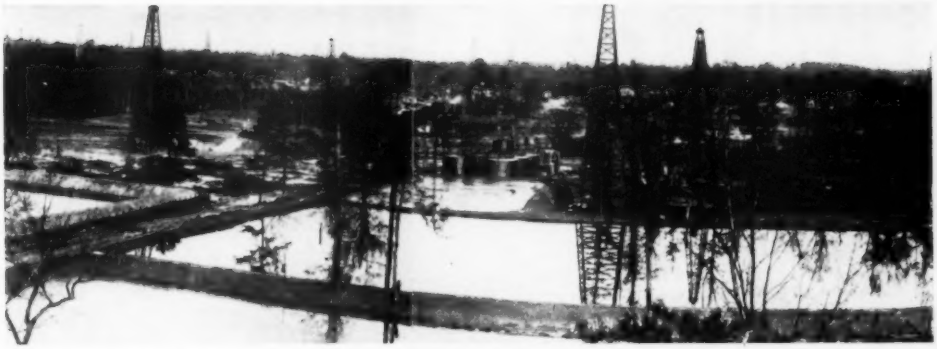

Hastily constructed earthen pits were used to store much of the oil produced in the fast development of the Smackover, Arkansas, field in 1923.

tionary development of statute law and better administration by regulatory authorities.

Oklahoma and Kansas have increased the effectiveness of conservation through the issuance of orders designed to fix a minimum well-head price. The Oklahoma Corporation Commission, in a hearing between Peerless Oil & Gas Co. and Cities Service Gas Co., was asked to fix a price in Guymon-Hugoton field. This it established at 7 cents a thousand cubic feet. The order was appealed to the Oklahoma Supreme Court and upheld by a five to four decision in 1950. Okla., 220 P. 2d 279. In December 1950 the order was sustained in the Supreme Court of the United States where it was said that a price-fixing order was lawful if substantially related to legitimate ends. Ample evidence was found to demonstrate that existing low field prices were resulting in economic and physical waste, thus laying an effective basis for the order. A similar move was undertaken in Kansas in 1948 with the establishment of well-head prices at 8 cents a thousand by an interim order of the Kansas Corporation Commission. The lower Kansas court sustained the order and appeals were taken to the Kansas Supreme Court.

New Mexico in 1949 adopted an improved law regulating the production of natural gas, integrated the proposal in the 1935 oil measure, and then enacted the draft into a single enactment to produce a modern conservancy statute.

In those areas where unit operation is workable from an engineering standpoint and feasible economically, compulsory unit operation of a common source of supply offers the ultimate in conservation of oil and gas. Physical waste of oil and gas, destruction of reservoir energy, and economic waste become minimal factors. Increased recovery of oil and natural gas may be expected from these applications.

While some voluntary unit operations are undertaken, state antitrust laws are thought to inhibit the natural development of these cooperative projects. The Texas Legislature in 1949 adopted a measure permitting the formation of voluntary units under certain circumstances and exempting them from antitrust action. The first agreement became effective in December 1949.

Oklahoma and Louisiana have chosen (the former directly, the latter indirectly and in a more limited fashion) to approach the problem by compelling the formation of units. Act 157 of 1940 authorized the Louisiana Commissioner of Conservation to require recycling in any pool producing gas where condensate or distillate was produced or natural gasoline extracted. Rules to establish unit operation in gas-condensate reservoirs have been effected, saving many millions of barrels of liquid hydrocarbons. Following abortive attempts in 1941 and 1943, the first compulsory unit operation measure was passed in Oklahoma in 1945. The Oklahoma Corporation Commission, when petitioned by at least 50 per cent of the lessees in area, was authorized to put under unit operation all or a part of a common source of supply, if that source might be separated, and where added amounts of oil and gas were economically recoverable. Ten compulsory units are now being operated in Oklahoma. Little opposition has existed in the units where time has been taken to educate those interested as to the possibilities and purposes of the unit and the law. Three actions are pending in the Supreme Court of Oklahoma contesting the orders forming the West Cement Medrano, the Chitwood Cunningham, and the Chitwood Spiers units.

SOUTHWEST *Production* PERSONALITIES

Some of the most important developments in oil production in use today had their inception and were brought to full flower in the Southwest. Here are biographical notes on some of the men responsible for the amazing progress of the industry in this region.

W. A. Alexander joined Shell Oil Co. after graduation from Louisiana State University. He served in various operating capacities, including work at The Hague, the Netherlands, headquarters of Royal Dutch-Shell. In 1944 he was placed in charge of the Houston area and is now Tulsa area manager.

O. C. Bailey, of Bailey & Trimble, El Dorado, Ark., as a partner with **J. D. Trimble,** El Dorado, entered Smackover field in 1923, with expanding interests that now include production in Arkansas and Texas.

Hines H. Baker, president of Humble Oil & Refining Co., Houston, was a law graduate from University of Texas. After serving in the artillery in World War I, he joined Humble's legal staff in 1919. He was elevated to the board of directors in 1937, and became president in 1948.

L. T. Barrow, chairman of the board of directors of Humble Oil & Refining Co., Houston, specialized in geology and received his master's degree from University of Texas in 1923. He organized Humble's geologic work in the San Antonio division in 1924.

Col. T. H. Barton, chairman of the board of Lion Oil Co., El Dorado, Ark., entered the oil business in 1921 as a president of El Dorado Natural Gas Co. In 1929 he headed Lion Oil, but his executive prominence extends to many corporations. He has received three honorary degrees as doctor of law.

Judge Amos L. Beaty was president of American Petroleum Institute, and was president and chairman of the board of directors of The Texas Co., Dallas. He resigned to organize Amos L. Beaty Oil Co. (Died 1939).

Robert Lee Blaffer was one of the organizers of Humble Oil & Refining Co. He went to Beaumont, Tex., in the early days of Spindletop and with the organization of Humble became one of the directors and a vice president. He became president in 1933 and board chairman in 1937. (Died 1942).

Burdette Blue was president of Indian Territory Illuminating Oil Co., Tulsa. He also served as president of the Kansas-Oklahoma division of the Mid-Continent Oil and Gas Association. (Died 1943).

E. H. Blum, vice president and general manager of crude-oil production for Atlantic Refining Co., Dallas, joined the company in 1905. In 1919 he worked in Texas as general manager of domestic producing activities.

P. H. Bohart, Tulsa, joined Gulf Oil Corp. in 1919 as field geologist, and was named assistant general agent of Mexican Gulf Oil Co. in 1926. Transferred to Tulsa in 1934 as vice president of the old Gypsy Oil Co. and Gulf Pipe Line Co. of Oklahoma, he was named assistant to the vice president of Gulf Oil Corp. in 1936. He was named vice president of Gulf in 1950.

William R. Boyd, Jr., Teague, Tex., consultant, is former president of American Petroleum Institute and one of the most widely known men in the oil industry. He formed the consulting firm of Boyd, Hardey & Wheelock in April 1950.

J. S. Bridwell, Wichita Falls, Tex., independent operator, is one of the most active independents in the State of Texas. He is a member of the National Petroleum Council.

E. F. Bullard, president and director of Stanolind Oil & Gas Co., Tulsa, entered the petroleum industry as a geologist with the old Dixie Oil Co. in 1921 after graduating from Yale University. Dixie became a part of Stanolind in 1931 and from 1932-45 Bullard held posts as vice president and director, and later executive vice president. He was named president in 1945.

Amon G. Carter, Fort Worth, entered the oil business after publishing the Fort Worth Star-Telegram for many years. He is one of the most active independent operators in West Texas.

J. A. Chapman, coowner of Chapman & McFarlin, Tulsa, organized McMan Oil Co. in Tulsa with **R. M. McFarlin.** The firm was sold to Magnolia Petroleum Co., Dallas, in 1916, and Chapman then organized McMan Oil & Gas Co. In 1930 stock of this firm was exchanged for Standard Oil Co. (Ind.) stock. Chapman & McFarlin was formed in the early 1930s.

A. E. Chester is vice president and manager of production for Magnolia Petroleum Co., Dallas. He started with the company in 1919 as a roustabout in the Desdemona, Tex., district.

William L. Connelly, Tulsa, retired in 1950 as chairman of the board of directors of Sinclair Oil & Gas Co. He joined the company in 1906, and for a time engaged in foreign work.

J. J. Conry, Tulsa, retired, was president of Carter Oil Co. First working in Ohio fields, he was sent to Romania by Standard Oil Co. (N. J.) where he remained until Germans overran the oil fields. He joined Carter's organization on returning to the United States.

James J. Cosgrove, chairman of the board of Continental Oil Co., Houston, has been general counsel since 1929, and a vice president since 1944. After graduating from Cornell University he received his law degree from University of Pittsburgh.

Edwin B. Cox, partner in Edwin B. Cox & Edwin L. Cox, Dallas, entered the oil business in 1922. He brokered 3,217 oil leases to major companies by 1929, and secured some production of his own. He formerly operated with Jake L. Hamon, Dallas.

John E. Crosbie was an independent producer and banker in the Mid-Continent area. As a tool dresser he started in Petrolia field in Canada. (Died 1938).

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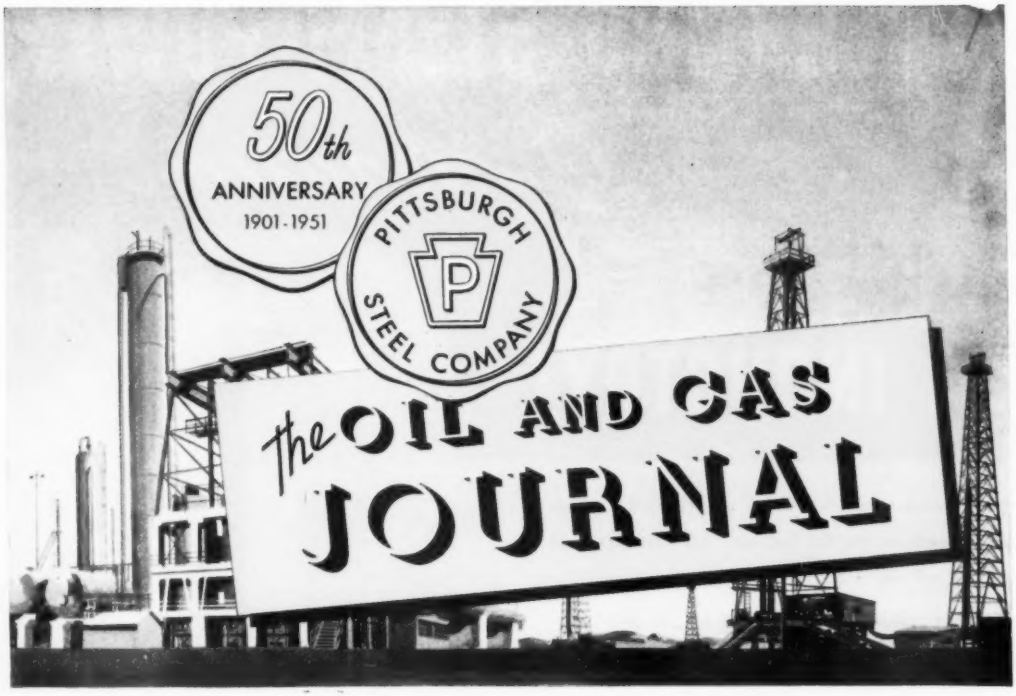

Both Serving The Oil Industry For Half a Century

Pittsburgh Steel Company is happy to congratulate the publishers of the Oil & Gas Journal on the occasion of fifty years of service to the oil industry by their publication.

This half-century of service is paralleled by Pittsburgh Steel Company which this year also celebrates its Golden Jubilee. As a pioneer in production of precision products for the oil industry Pittsburgh Steel is proud of the part it has played in this great enterprise.

This Anniversary year also is marked by the greatest expansion program in the history of Pittsburgh Steel. As a result we expect to keep pace with the oil industry's demand for more and better steels with which they produce and market oil.

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Hugh Roy Cullen, president of Quintana Petroleum Co., Houston, had his first production success in Pierce Junction field, Texas. Greater results followed when he opened Blue Ridge and Rabbs Ridge fields. University of Pittsburgh conferred on him the doctor of science degree.

E. D. Cumming is vice president of exploration and production east of the Rockies for Shell Oil Co., Houston. A graduate of Alabama Polytechnic Institute, he joined Shell in 1923. He served as director of refining for Petroleum Administration for War during World War II.

W. F. Dalton, president of Placid Oil Co., Shreveport, entered the industry through Union Oil Co. in 1922. He joined Placid in 1940.

Joseph Danciger was vice president in charge of production for Danciger Oil & Refining Co., Tulsa. He began his career in Kansas City in 1917, and pioneered in Panhandle and Mexia fields of Texas. (Died 1948).

W. N. Davis was an independent operator and vice president of Phillips Petroleum Co., Bartlesville, Okla. A pioneer in unit operation of oil pools, his ability in protecting tax interests of the industry made him a national figure. (Died 1950).

Frank H. Dunn, Tulsa, attained presidency of H. F. Wilcox Oil & Gas Co., Tulsa, in 1943 after serving as roustabout, pipe-line pumper, and warehouseman before advancing to executive duties in 1923.

J. H. Evans, Tulsa, was elected "Grand Old Man of the Oil Industry" in 1928. He was founder and president of Devonian Oil Co., and for several years was a director of the Mid-Continent Oil and Gas Producers Association. (Died 1936).

William S. Farish was president of the board of Standard Oil Co. (N. J.) and one of the founders and a president of Humble Oil & Refining Co. He was a law graduate and became a drilling contractor and later a Gulf Coast producer. (Deceased).

Everett R. Filley is general manager of the production department of The Texas Co., Houston. He studied law at University of Kansas, and joined the company as a clerk in the accounting department.

H. V. Foster was president of Indian Territory Illuminating Oil Co., which was later absorbed by Cities Service Oil Co. The company drilled the discovery well of Oklahoma City field. (Deceased).

David Frame, vice president in charge of production for Humble Oil & Refining Co., Houston, since 1945, started with the firm as a scout in 1919, advancing to superintendent of production. He was elected to the board of directors in 1941 and became vice president in 1946.

Jacob France, chairman of the board of Mid-Continent Petroleum Corp., Tulsa, has been with the organization since 1913 when it was organized as Cosden & Co. France was vice president and general counsel for Cosden, and served as Mid-Continent's president prior to his present position.

John J. Frommer is division manager of Ohio Oil Co. at Shreveport. Starting as a roustabout and pumper, he became district superintendent in Yates, Texas, field.

H. B. Fuqua, chairman of the board of Texas Pacific Coal & Oil Co., Fort Worth, is a former president of American Association of Petroleum Geologists. He graduated from University of Oklahoma and started his career with Gulf Oil Corp.

William H. Garbade, Tulsa, had 15 years of background experience with Shell Oil Co. before becoming president of Deep Rock Oil Corp., Tulsa, in 1948. He holds a master's degree from New York University's College of Commerce, Accounts, and Finance.

George C. Gibbons, Dallas, became executive vice president of Texas Mid-Continent Oil and Gas Association in 1936. He received a citation from Petroleum Industry War Council and War Production Board for services rendered during World War II. (Died 1946).

Rush Greenslade, Tulsa, retired in 1950 as vice president of Gulf Oil Corp. He apprenticed himself to pipe lining as an office boy for Buckeye Pipe Line Co., and joined Gulf's legal department in 1914.

Henry N. Greis, Tulsa, was president of Deep Rock Oil Corp., and Burke-Greis Oil Corp. He held a directorship in Mid-Continent Petroleum Corp. and Oklahoma Natural Gas Co. (Died 1947).

L. A. Grelling, independent operator at Tyler, Tex., entered the oil industry in 1917 at Houston, with Simms Oil Co. Following World War I he joined Humble Oil & Refining Co., and in 1926 became an independent operator.

Jake L. Hamon, independent producer, Dallas, was elected president of Mid-Continent Oil and Gas Association in 1950. He first drilled in Ranger, Texas, field. Formerly operating in partnership with **Edwin B. Cox,** he became president of the Texas Mid-Continent Oil and Gas Association in 1935.

B. A. Hardey, Shreveport independent producer, entered the oil business in 1912 at Markham field, Texas. He joined Gulf Refining Co. at Shreveport in 1914, and in 1925 resigned to help organize United Gas Corp. He served as executive vice president of the firm's subsidiaries for 6 years and aided in organization of Republic Gas Corp. He resigned in 1932 to turn independent.

Frank Haskell, retired, was former head of Tide Water Associated Oil Co. operations in the Southwest, with headquarters in Tulsa. He started as a lease worker on his father's Pennsylvania wells, and joined Tide Water in 1908.

William G. Helis, Sr., discovered several major oil fields in South Louisiana. Helis, who made his home in New Orleans, was a native of Greece and came to the United States in 1904. (Died 1950).

Curtis L. Henderson, Wichita, was president of Vickers Petroleum Co. He was former head of Western Petroleum Refiners Association. (Died 1947).

Judge J. C. Hunter, Abilene, Tex., was a prominent teacher, banker, jurist, and oil producer. He served as president and Washington counsel of Mid-Continent Oil and Gas Association for several years. (Died 1945).

J. C. Hurley, president of Grace Oil Co., Houston, entered the oil industry as a roughneck in Powell, Tex. In July 1926 he became an independent, and became an active oil producer in East Texas in 1931.

John W. Jordan, Tulsa, vice president, Sinclair Oil & Gas Co., started with the firm as gang pusher in 1916. After serving in the Army, he was promoted to field superintendent, and later had charge of operations in East Texas field.

Raymond B. Kelly, manager of the Fort Worth Division of Pure Oil Co., was first with the United States Bureau of Mines. In 1925 he joined Pure as division production engineer in Mexia, Tex.

Dana Kelsey, Tulsa, is a retired vice president of Sinclair Prairie Oil Co. From the United States Indian Service he joined old Prairie Oil & Gas Co.'s land department, and later became vice president and general manager.

E. Rogers Kemp was formerly president of Sinclair Oil & Gas Co. His career began as a clerk for Richard Jennings & Sons, oil producers, Pittsburgh, in 1899. (Deceased).

M. J. Kirwan entered the oil industry as field engineer for Associated Oil Co. in California. He was with the United States Bureau of Mines at Bartlesville, Okla., for 3 years, and has been manager of production for Cities Service Oil Co., Bartlesville, for 10 years.

George H. Lang, independent oil operator, Tulsa, formerly was vice president of Carter Oil Co. Beginning with the firm as an oil scout, he became chief scout and later assistant to the president.

Frank Adair Leovy, for 10 years executive head of Gypsy Oil Co., Tulsa, later became chairman of the board of Gulf Oil Corp. (Died 1949).

Clarence H. Lieb, Tulsa, was president of Carter Oil Co. Later he was president of Creole Petroleum Corp. (Deceased).

Dillon Alva Little retired in 1946 as president of Magnolia Petroleum Co. and Magnolia Pipe Line Co., Dallas. He joined Magnolia in 1914 and was elected president in 1933. He was the first president of Dallas Petroleum Club. (Died 1950).

Capt. J. F. Lucey was chairman of the board of Lucey Petroleum Co., Dallas. He was president of Lucey Manufacturing Co., New York City, Talco Asphalt & Refining Co., and Talco Pipe Line Co., Mount Pleasant, Tex. (Died 1947).

E. W. Marland, Ponca City, Okla., was founder and head of Marland Oil Co. He was a former governor of Oklahoma and at one time was head of a huge oil empire. His firm was merged with Continental Oil Co. in 1929. (Died 1941).

Edgar L. Marston was chairman of the board of Texas Pacific Coal & Oil Co. At 23 he organized his first business, and later entered the Texas coal industry with his father-in-law, **R. D. Hunter.** He was active in Ranger pool of Texas. (Deceased).

T. M. Martin, president of Lion Oil Co., El Dorado, Ark., as a college graduate started from "scratch" as stenographer. He worked his way up through various companies until joining Lion in 1929, and was made president in 1947.

Glenn McCarthy, chairman of the board of McCarthy Oil & Gas Co., McCarthy Chemical Co., and New Ulm Corp., all of Houston, was born at Spindletop, Tex., and worked as a roughneck during his college years. He entered the oil business as a wildcatter in 1934, and in 1939 organized McCarthy Oil & Gas. He remained president of the firm until February 1950.

R. Otis McClintock is president of First National Bank & Trust Co., Tulsa. Starting in the warehouse, he joined old Gypsy Oil Co. in Glenn pool, Oklahoma, and later became a vice president of the firm.

Edward H. McCollough received his master's degree in geology from Oklahoma University before joining Amerada Petroleum Corp., Tulsa, as staff geologist. In 1928 he initiated the firm's operations in California. He became vice president in charge of the Tulsa office in 1949.

E. B. McFarlin, coowner of Chapman & McFarlin, Tulsa, first entered the oil business in 1913 when he joined McMan Oil Co.'s production department. In 1916 the firm was sold to Magnolia Petroleum Co., and he was named to head the production department of the newly organized McMan Oil & Gas Co. In 1930 when stock was exchanged for Standard Oil Co. (Ind.) stock, he formed a partnership with **J. A. Chapman,** Tulsa, and the present firm was established.

M. J. McLaughlin was vice president of production for Magnolia Petroleum Co., Dallas, before retirement in 1944. He acquired his executive position after starting as a roustabout in Clarion County fields of Pennsylvania. (Died 1948).

Edward H. Moore, Tulsa independent oil operator, discovered Fitts pool. He served as United States senator from Oklahoma. (Died 1950).

Dan J. Moran was president of Continental Oil Co. Previously he was vice president of The Texas Co. (Died 1948).

C. H. Murphy, Jr., president of Murphy Corp., El Dorado, Ark., began his own operations after 3 years as roustabout and scout. He discovered New London field in Union County, Arkansas, and Delhi field in Richland Parish, Louisiana.

Maston Nixon, executive vice president of Southern Mineral Corp., Corpus Christi, entered the oil business in 1931 when Southern Minerals and Southern Pipe Line Co. were organized. Since their organization, he has been in charge of management of both companies.

John F. O'Shaughnessy is vice president and general manager of Globe Oil & Refining Co., and Lairo Oil & Gas Co., Wichita. He is a graduate of Georgetown University and joined Globe in 1931.

George Parker, president of Lewis Oil Co., San Antonio, entered the oil industry in West Virginia, later moving to Texas.

F. B. Parriott, chairman of the board of Sunray Oil Corp., Tulsa, received his early experience in West Virginia and Pennsylvania oil fields. He was president of Transcontinental Oil Co. from its organization until its merger with Ohio Oil Co. in 1930.

Jubal Richard Parten, president of Woodley Petroleum Co., Houston, has been in the oil business since 1919. In 1922 he helped organize Woodley Petroleum Co. and served as treasurer until 1927 when he was named general manager and president. He also aided in organizing Premier Oil Refining Co. of Texas in 1935.

William M. Peck is a division manager of the southwestern producing division for Pure Oil Co., Tulsa. A law graduate from University of Missouri, he started as a roustabout for Pure in Seminole field of Oklahoma in 1927.

Waite Phillips was a Mid-Continent pioneer in Osage field, Oklahoma. Later he organized his own

company which was purchased by the old Barnsdall Oil Co. in 1925. He is noted for numerous philanthropies.

Earle S. Porter has a master's degree from University of Oklahoma, and studied at University of Chicago and Columbia University. He entered the oil industry with the du Pont organization in 1918 and transferred to Amerada Petroleum Corp., Tulsa, in 1920. He was named a vice president in 1937.

L. H. Prichard, chairman of the board of Anderson-Prichard Oil Corp., Oklahoma City, was one of the company's founders. (Died 1949).

Ralph J. Pryor, Wichita, is a pioneer independent operator. He has been a director of Independent Petroleum Association of America since its organization.

Edwin B. Reeser, retired, former president of the old Barnsdall Oil Co., started work as a railroad telegrapher, and switched to office boy for United Natural Gas Co. at Oil City, Pa., in 1891. He headed various association activities, and for three terms was president of the American Petroleum Institute.

Roland V. Rodman, Oklahoma City, became president of Anderson-Prichard Oil Corp. in 1947. Prior to his present position he was president of Bay Petroleum Co., Denver. This association began in 1937, and led to advancements which made him president in 1946.

Charles F. Roeser, prominent Mid-Continent operator and president of Roeser & Pendleton, Inc., Fort Worth, served as president of American Petroleum Institute and Independent Petroleum Association of America. (Died 1949).

J. E. Roth, vice president and production manager for Tide Water Associated Oil Co., Tulsa, has been with the firm since 1924. A graduate of Cornell University, he joined Tide Water as a roustabout and gradually advanced in the production department, serving as chief engineer and production manager. In 1943 he was appointed assistant vice president and in May 1949 was named vice president.

Oscar C. Schorp was elected president of Carter Oil Co., Tulsa, in 1943. He entered the oil industry through the Latin-American affiliates of Standard Oil Co. (N. J.), and was made vice president and manager of Carter's producing department in 1939. He was named executive vice president in 1941.

Walter Sharp, Houston, in 1893 drilled within 30 yd. of the Spindletop well. The test was shut down, short of production, because of financial difficulties. Later he organized Producers Oil Co. which became part of The Texas Co. (Died 1912).

W. G. Skelly, Tulsa, president of Skelly Oil Co., entered the oil business in 1893 in Venango County, Pennsylvania. He managed Citizens Gas Co., Gas City, Ind., for 2 years, and then moved to Illinois as drilling contractor and oil operator. He moved to Tulsa in 1913, and built a refinery at El Dorado, Kans., in 1917. In 1919 he organized Skelly Oil Co. and has headed the firm since.

D. R. Snow, Tulsa, vice president and general manager of Sunray Oil Corp., majored in geology at University of Chicago. He joined Waite Phillips Oil Co. to become its chief geologist. In 1935 he was named vice president of the old Barnsdall Oil Co. When that firm was absorbed by Sunray, he became vice president.

A. L. Solliday, Tulsa, gained his degree in geology from University of Oklahoma in 1923. Starting as scout for the Old Dixie Oil Co., he became district geologist. With Stanolind's organization he was made manager of the land department. He was elected executive vice president of the firm in 1948.

Hugh M. Stalcup, Tulsa, retired as vice president of Skelly Oil Co. He was a leader in conserving natural resources of the Texas Panhandle area. (Died 1949).

R. S. Sterling was one of the founders of Humble ble Oil & Refining Co., and was a former company official. He served the State of Texas as governor for two terms. (Died 1949).

Herbert R. Straight, retired, was formerly chairman of the board of Cities Service Oil Co., Bartlesville, Okla. A Stanford University graduate, he learned production under his father in the Pennsylvania fields. In 1911 he came to Oklahoma and worked with the late T. N. Barnsdall.

H. C. Teasdale, president of The California Co., New Orleans, is a University of Utah graduate. He started his business career with Standard Oil Co. of California in 1920 on the controller's staff. His rise through successive promotions led to the presidency in 1947.

E. R. Turner, president of Pan American Production Co. and affiliates, Houston, began his oil career with The Texas Co. in 1914. He continued with the firm until 1929, when he became assistant to the vice president of Continental Oil Co. In 1935 he organized Pan American Production Co.

V. S. Welch, president of Calumet Refining Co. and an independent oil producer from Artesia, N. M., began as a drilling contractor in 1898 in New York fields. Moving steadily westward, his operations span Indiana, Illinois, Kentucky, Kansas, Oklahoma, Wyoming, and New Mexico.

L. H. Wentz, Ponca City, Okla., was famous in the earlier Mid-Continent annals for his spectacular success as wildcatter and developer. He was prominently connected with Tonkawa and Blackwell fields of Oklahoma.

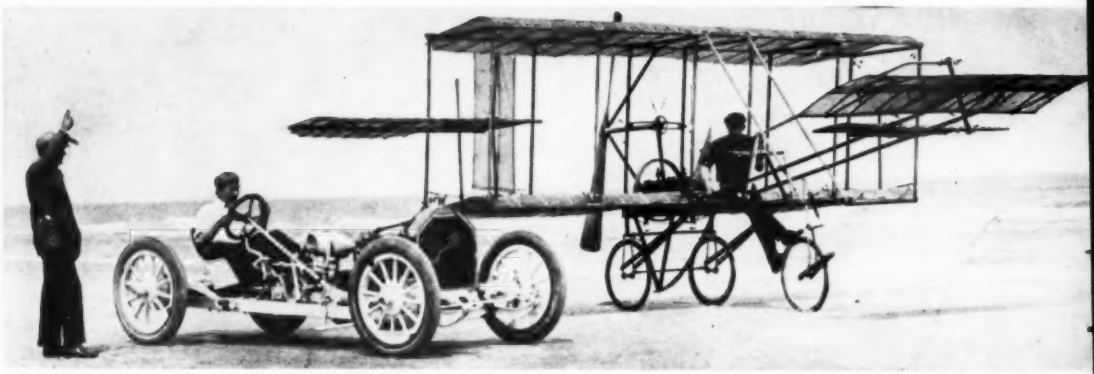
F. C. Wilson, president of Wilson Oil Co., Santa Fe, drilled several tests in Texas and New Mexico before developing Lea County, New Mexico, production.

W. C. Woolf, Shreveport, is a Spindletop veteran and independent operator as a partner in Woolf & MaGee and Ray & Woolf, Shreveport. He drilled the first producing well for Caddo Gas & Oil Co. in Caddo Parish, Louisiana. He began independent contracting and producing operations in 1908.

Clarence H. Wright, president of Sunray Oil Corp., joined the firm as a director in 1921. He was named vice president and general manager in 1923, and president in 1927. Under his leadership the old Barnsdall Oil Co. was merged into Sunray in 1950.

Charles J. Wrightsman, president of Wrightsman Oil Co., Fort Worth, was an attorney before entering the oil business in 1904. He became one of the largest independent operators in the Southwest.

C. E. Yager, president of Texas Pacific Coal & Oil Co., Fort Worth, pioneered in many producing fields in the Permian basin. In 1922, following graduation from University of California, he joined T. & P., becoming chief geologist in 1929 and president in 1949.



More fuel oil was the pressing objective of refiners when Spindletop was discovered. This 1907 racing scene presaged the dominance of gasoline production for car and plane in refinery processing.

U.S. Refining Centered in

THE economy of the Southwest was in need of Spindletop when the discovery of the original well first became known throughout the area in January 1901. The several states that comprise the area were described at that time as a "vast empire whose slow growth was largely confined to agricultural pursuits."

Most of the large rail systems had been built and were used to transport "raw products out and the finished products into the area." Petroleum was among the essentials that had to be shipped in by water or rail over long distances at high delivered costs. Coal was the principal fuel. The limited industry was largely local in scope.

The Southwest had less than its share of the 8,000 automobiles in use in the United States at the close of 1900. There were no improved highway systems on which to use them.

Spindletop and the oil discoveries of the next decade changed all this. Petroleum refining rapidly became an important industrial enterprise and it supplied the products upon which other industries were established. Re-

A 1913 rear view of still and early fractionating equipment at the Port Neches, Tex., refinery of The Texas Co.

Heater and fractionating column (Foster Wheeler design) at the Sweetwater, Tex., refinery of the Gulf Refining Co. in 1923.

The Spindletop discovery soon brought changes in this early-day scene of a dirt road, flat tire, and coal-burning locomotive.

The Southwest lagged far behind the rest of the nation economically until refining brought it adequate petroleum and a new industry which supplied nation-wide and world-wide markets. Here is the story of this exciting phase of the region's history.

by C. O. Willson

Southwest...

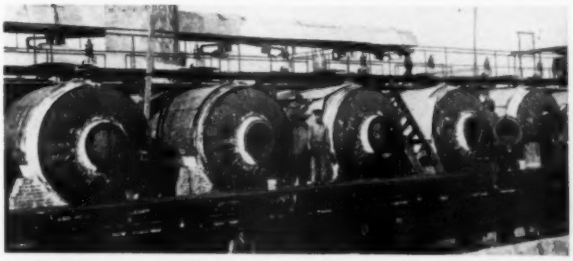
fining in the Southwest previous to 1901 was largely confined to two plants: that of Corsicana Refining Co. (later Magnolia Petroleum Co.) at Corsicana, Tex., and the Neodesha, Kans., plant of Standard Oil Co.

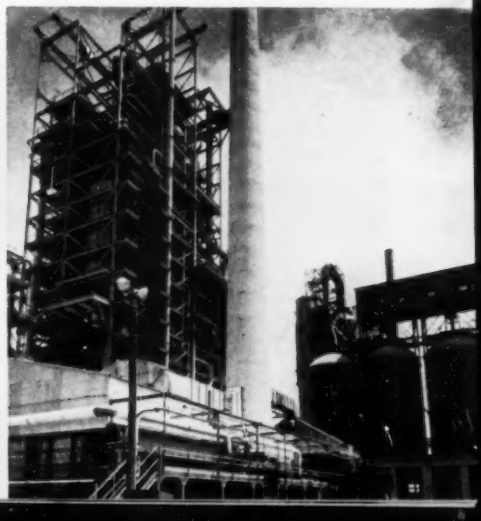
Spindletop presented a new problem in refining. Its crude contained large quantities of sulfur compounds and the gravity was generally 20° to 24° A.P.I. A Standard Oil official of that time advised his headquarters that the Spindletop well had little or no significance because of the undesirable characteristics.

Fortunately other investigators realized that the economy of the United States and the entire world was ready for the greatly increased production of fuel oil. There had been a steady increase in the demand for fuel oil refined from crude oils east of the Mississippi River. The fuel-oil yields were not large and prices, due largely to transportation costs, were high for many buyers. It was realized that the Spindletop crude could supply a large part of this existing fuel-oil market and develop new outlets in this country and other countries at prices which would be attractive to buyers.

J. M. Guffey Refining Co., which was shortly thereafter taken over by Gulf Refining Co., had a plant in operation at Port Arthur, Tex., in 1902, being connected to Spindletop field by a crude-oil line. The same year a company,

Top, below: Southwest's first thermal cracking battery (Burton process) installed at Neodesha, Kans., refinery of Standard Oil Co. (Kansas) in 1914. Bottom: Three original lube stills at Ponca City, Okla., refinery of Cities Service Oil Co., built in 1912. Right: The Southwest's first fluid cracking unit completed at the Baton Rouge, La., refinery of Esso Standard Oil Co. in 1942.





which became part of The Texas Co., started the construction of a second plant at Port Arthur, and it was on stream in 1903. In 1902 the predecessor of Magnolia Petroleum Co. completed a plant at Beaumont, Tex. These are now three of the largest and most complete refineries of the petroleum industry.

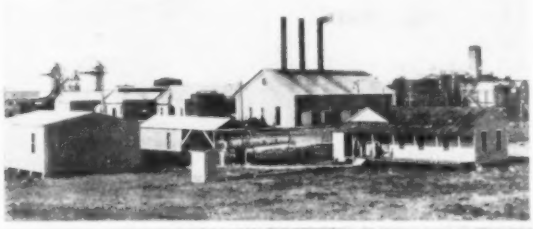
In 1905 the discovery of Glenn pool, south of Tulsa, brought a major change in refinery development which was further emphasized when the still more important Cushing field was discovered in 1912. The sweet crude from both Glenn and Cushing fields was mixed base with a gravity averaging around 36° A.P.I.

Not only did the crude give a substantial yield of straightrun gasoline but it also had a wide fraction, 10 to 20 per cent, of kerosine which was comparable in quality with kerosines obtained from eastern crudes.

Oklahoma Crude to Gulf

The owners of the new refineries in the Gulf Coast found they were handicapped in having only low-gravity crudes for processing and they quickly became interested in the possibilities of the supplies available, starting in 1906, from Glenn pool. In 1906 Gulf Pipe Line Co. started a line to Glenn pool, connecting to its line system in the Gulf Coast area. This enabled the company to make major changes in 1907 in its refinery output at Port Arthur. In 1907 The Texas Co. also completed an 8-in. line to Glenn pool which made the crude available to its Port Arthur refinery.

Another reason for the decision to build pipe lines from the new fields in Oklahoma to the Gulf Coast was the disparity of prices in favor of the Oklahoma crudes. In 1905 when Gulf Oil Corp. decided to build its pipe line,



The start (1902)—the halfway point (1926)—and 1950 at the Port Arthur works of The Texas Co. A few-hundred-barrel topping plant was gradually expanded into today's 190,000-bbl. complete refinery.

The evolution from this small topping plant (above) of Marland Oil Co. in 1919 to the 52,500-bbl. modern refinery and office facilities (right) of Continental Oil Co. is a highlight in Mid-Continent refinery growth.

the 32°-gravity Glenn pool crude was selling generally for 39 cents a barrel, while Texas producers were asking 65 cents for a 22°-gravity crude at the gulf.

Glenn pool and later Cushing pool quickly brought Oklahoma to the front as a refinery center. From 1905 to 1913, 20 plants were built in Oklahoma within a radius of 100 miles from the two fields. Most of them were small plants.

At the same time larger companies started to build pipe lines which connected to refineries in Kansas, Kansas City, Mo., and to refining centers outside the Southwest. Prairie Oil & Gas Co. in 1905 made Glenn crude available to the Neodesha refinery of Standard by building a line from the pool to connect with its system in southern Kansas.

It was at this time that the trends in crude supplies, transportation, and market conditions, which were to be controlling in the expansion of refining in the Southwest for a period of 20 years, were definitely established. Several areas in which these trends were apparent can be pointed to.

A number of small refineries were generally

There was a period of 23 years between the first frame office building at the Phillips, Tex., refinery of Phillips Petroleum Co. and the modern facilities of the present plant.

The original shell-still battery built in 1909 at the Baton Rouge, La., refinery of Esso Standard Oil Co.

built within 1 to 3 years whenever a new field was discovered representing a sizable reserve. Invariably these fields were rapidly developed with little regard to the conservation principles now generally recognized as an essential part of a sound development program.

The first result was an excess of crude-oil production which was available to a small refinery located in a field or a few miles away at prices under the markets prevailing in older areas. The first Spindletop oil was purchased by the first refiners for 2 to 5 cents a barrel and sales of Glenn pool crude were made as low as 10 cents per barrel.

The pipe-line operators with lines connected to the large refineries within the Southwest and other parts of the country did not extend their systems to the newer fields until it was definitely established that a substantial production over a period of years would be available.

While a large number of the skimming plants were built and abandoned over a period of 20 years in the Southwest, there were cases in which the owners expanded their plant capacities from time to time and by extending their pipe-line systems were able to obtain adequate supplies so that the plants have become a permanent part of the refining industry in the Southwest. The West Tulsa refinery of Mid-Continent Petroleum Corp., originally built by J. S. Cosden after the discovery of Glenn pool; the Cushing, Okla., refinery of Deep Rock Oil Corp.; the Wichita Falls, Tex., refinery of Panhandle Refining Co.; the El Dorado, Kans., refinery of El Dorado Refining Co., and the Lion Oil Co. refinery of El Dorado, Ark., are examples of plants which were built to operate with crude from the new fields and which have been operated continuously since that time and are now part of the permanent refining industry of the Southwest.

REFINERIES OF THE SOUTHWEST—1918

Year built	Kans.	Okla.	Tex.	Ark.	La.	Total
1892	1	0	0	0	0	1
1898	0	0	1	0	0	1
1901	0	0	1	0	0	1
1902	0	0	2	0	0	2
1903	0	0	3	0	0	3
1904	1	0	0	0	0	1
1905	1	2	0	0	0	3
1906	8	3	1	0	1	13
1907	2	1	0	0	0	3
1908	0	3	0	0	0	3
1909	3	0	0	0	2	5
1910	0	3	0	0	0	3
1911	0	2	2	0	1	5
1912	0	2	1	0	1	4
1913	0	4	1	0	0	5
1914	1	6	1	1	0	9
1915	2	8	5	0	2	17
1916	2	15	4	0	5	26
1917	13	36	5	0	2	56
1918	5	21	17	0	4	47
Total	39	106	44	1	18	208

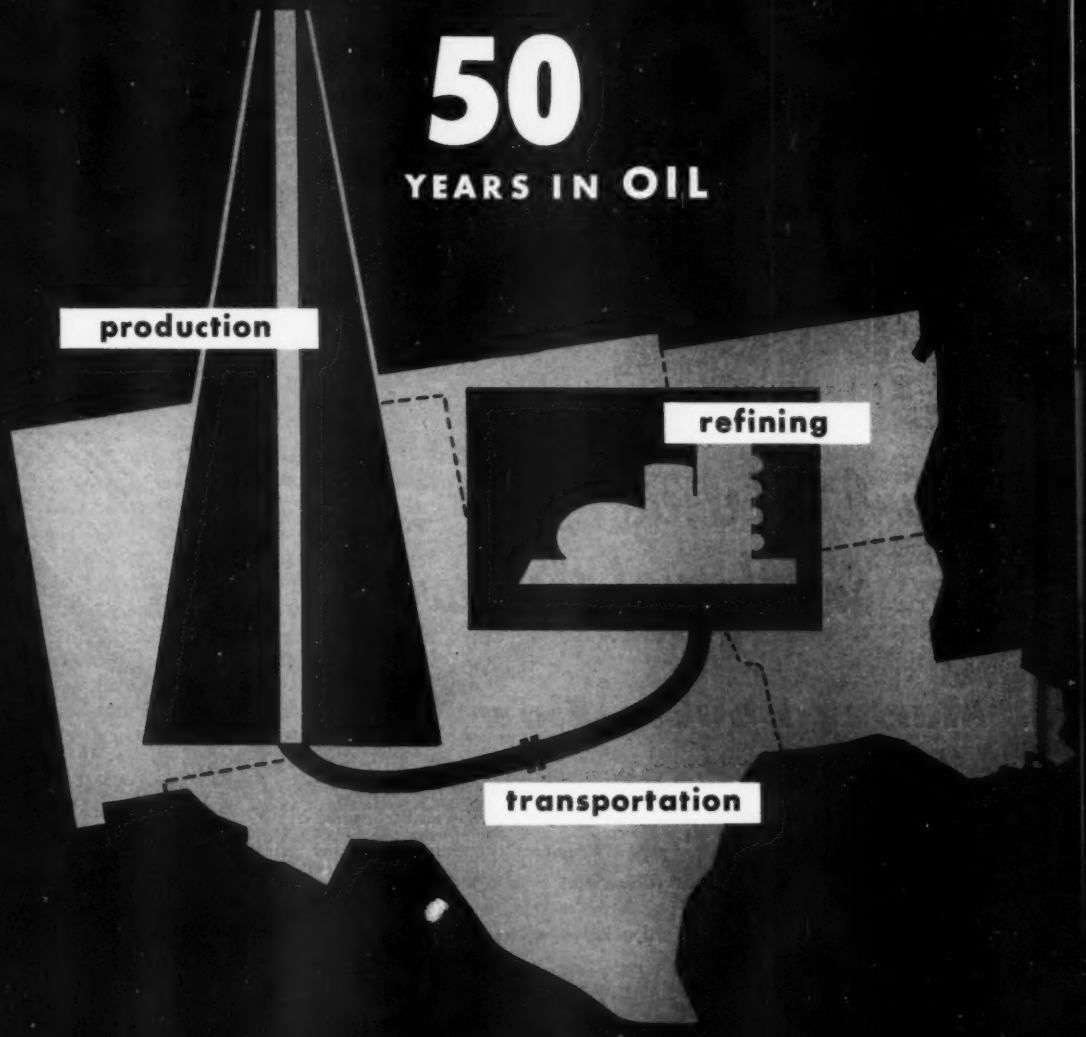
In addition to the above, several refineries were built and dismantled. Several refineries were listed as under construction or predicted at the close of 1918.

The Southwest also supplied crude oil for new refineries located in Kansas City, Mo., and East St. Louis, Ill. In 1918, the Missouri refineries totaled five, one of which was built in 1907, one in 1914, one in 1915, and two in 1917. In 1918, the East St. Louis refineries totaled five, one refinery being built in 1906, one in 1909, one in 1912, and two in 1918.

This is the original topping plant built at Tulsa in 1913 by Josh Cosden, a colorful figure for many years in southwest refinery operations. This has been expanded into the present 50,000-bbl. modern refinery of Mid-Continent Petroleum Corp.

TEXAS • • • OKLAHOMA • • • NEW MEXICO • • • ARKANSAS • • • LOUISIANA

50
YEARS IN OIL



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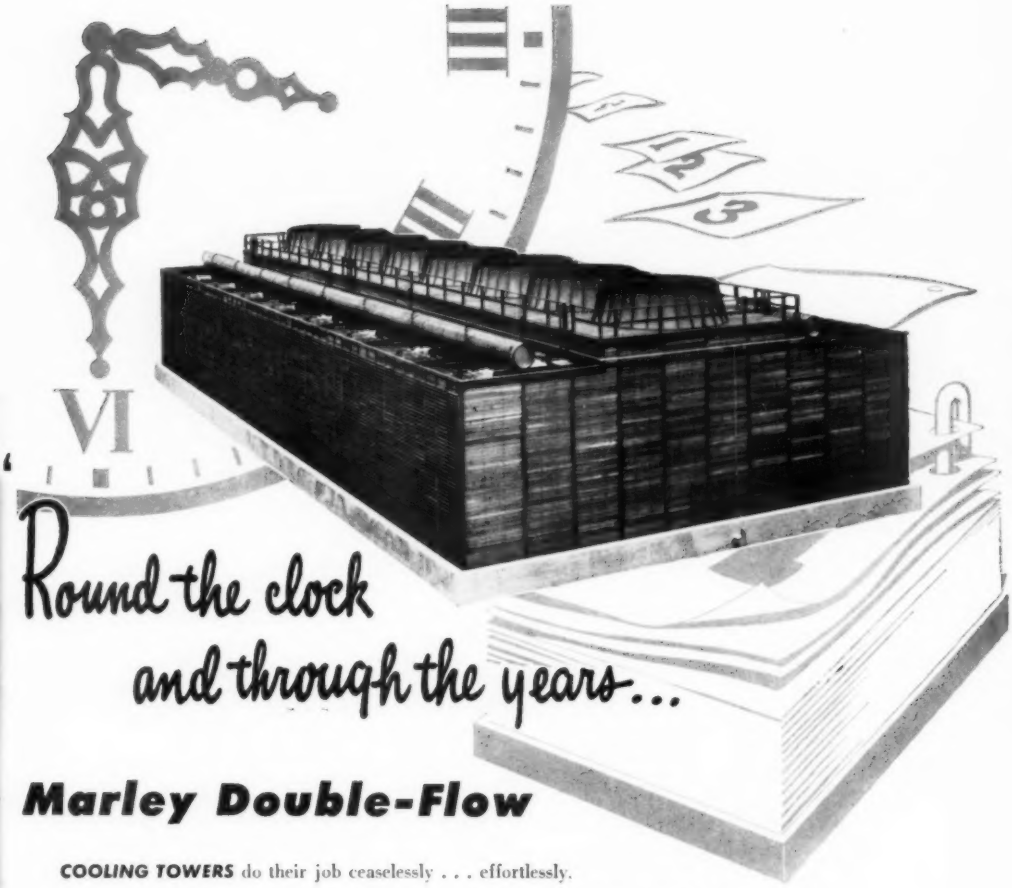

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COOLING TOWERS do their job ceaselessly . . . effortlessly. Designed for long-service life, Double-Flow dependability is further assured by the patented design that makes possible "at-a-glance" inspection, on-the-spot maintenance—all without service shutdowns or lag in plant production.

The famous Marley open distribution system keeps the operator informed at all times on water conditions, and may be cleaned in minutes, during operation. By merely opening a door, the operator can walk through the entire tower, inspecting all essential parts as the Double-Flow continues to do its duty.

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MARLEY

One of several refineries built in the Cushing, Oklahoma, field during the boom period. This plant was operated by Roxana Petroleum Corp. (Shell) for several years and then dismantled.

War I Boom

The accompanying table taken from information published in The Oil and Gas Journal shows the refinery situation in the Southwest during the final year of World War I. That war proved to be a big boom to refinery construction. The war demands were heavy, starting in 1915, and prices were generally favorable to refinery operators. In addition, several new fields were discovered during that period so additional supplies were available.

In 1915, 17 refineries were constructed in the Southwest, followed by 26 in 1916, 56 in 1917, and 47 in 1918. This phenomenal growth centered in Oklahoma which for several years was the heart of the refining industry of the Southwest and was so recognized in refinery markets. Starting in 1918 construction of new plants expanded rapidly in Texas, particularly in North Texas, following the discovery of Burkburnett field in the early part of 1918.

The 145 operating plants in Oklahoma and Kansas at the close of 1918 brought those two states to the forefront as suppliers of petroleum products. During the war shipments of products from these two states to the Gulf Coast for coastwise and export movement expanded rapidly. The output of the larger refineries located in the Middle West and East did not take care of the rapidly increasing domestic demands in that area and buyers looked to the Southwest for supplementary supplies. This resulted in what commonly became known as the Oklahoma (Group 3) market which was recognized nationally and internationally as the base market in the sale of petroleum products for many years and is still generally used in sales within the Southwest and the Middle West.

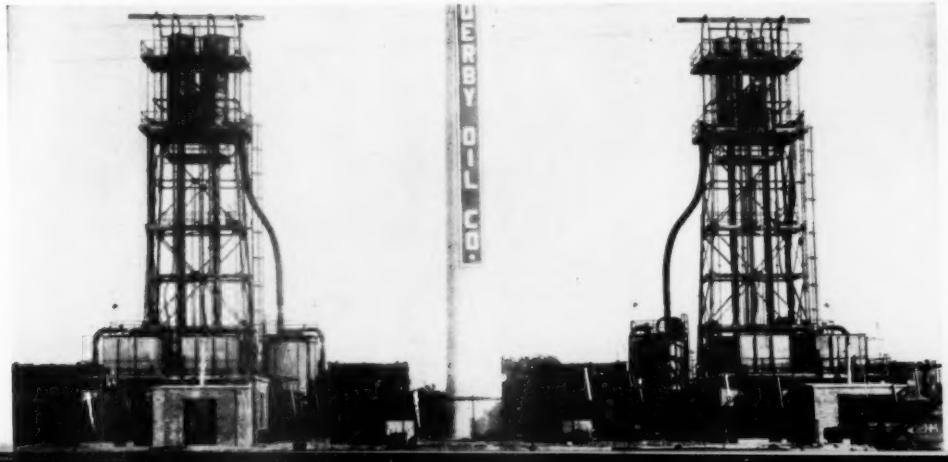
Refining Methods

The first refineries in the Southwest used methods adapted from the refineries which had been operating up to 40 years in other parts of the country. The cheese-box still widely used in eastern refineries from 1860 to 1890 was installed in some of the first plants in the Southwest. The bulk of early distillation, however, was done with shell stills.

The first stills were generally of 200 to 600 bbl. capacity and later were expanded to as high as 1,200 bbl.

The original operations used the batch method. A still was operated as a unit, the products being taken overhead at temperatures

One of the first installations (1923) of the Dubbs cracking process at the Wichita, Kans., refinery of Derby Oil Co.



varying from 200° to 1,000° F. There was little or no controlled fractionation of overhead products in the early operations and this necessitated the rerunning of the naphtha and distillate fractions in order to secure the finished gasoline and kerosine cuts.

Southwestern refiners quickly adapted their plants to the continuous shell-still operation which added greatly to their efficiency. In this operation a battery of two or more stills was so connected that the charge passed continuously from one still to another—operated at different temperatures—until the distillation operation was completed.

At about the same time, the refining industry became conscious of the possibilities of savings through fractionation. The original towers were little more than empty shells, the efficiency of which was greatly increased through the use of baffles, bubble-type, and various packing arrangements which gave a refiner control over the specifications of the recovered products.

1914 Operation

A typical crude-distillation facility in Oklahoma in 1914 consisted of a battery of five shell stills, each with a capacity of 300 bbl. The first still was operated at a temperature of about 300° and from it was recovered a light gasoline fraction which, a couple of years later, was in demand as blending material in the production of the early aviation gasolines. The next two stills at operating temperatures of 375° to 500° F. recovered a naphtha cut of 54° A.P.I. Temperatures were increased about 50° in the fourth still and from this still was recovered a kerosine distillate of 40° A.P.I. The last still, with a temperature in excess of 600°, was operated to obtain the largest possible yield of gas oil, varying in gravity from 30° to 34° A.P.I.

The residuum product from the last still was a commercial grade of fuel oil varying in gravity from 22° to 26° A.P.I.

This residuum from the last still passed through the coil of a heat exchanger in going to storage. By pumping the crude charge through the shell of this heat exchanger the operators were able to pick up 50° to 100° F. before the crude entered the first shell still.

None of the products of this operation were ready for marketing except the gas oil and fuel oil. At this plant naphtha cut from the crude still battery was rerun in a battery of two 300-bbl. shell stills. In the rerun operation a gasoline meeting U. S. motor-gasoline specification was obtained by blending the product from the first still with the high-gravity product of the first crude still. In the second still of the rerun battery, two products were received. One was 52° naphtha which was sold for blending with natural gasoline. A small yield of high-gravity kerosine was also secured.

The kerosine distillate from the crude battery was rerun in a steam still. The principal product was a kerosine cut which was blended with the kerosine from the first rerun battery. The residue from the steam operation was a 34°-gravity distillate which was either sold with that specification or was blended with the gas oil. The chemical treating operation for the gasoline, naphtha, and kerosine cuts consisted of a sulfuric acid treatment and soda sweetening at batch agitators.

During World War I a few refiners began

Until conservation and the application of proration regulations became controlling in production operations, each new major field brought construction of a number of small refineries. The one shown here operated for several years in East Texas field.

if he could look back
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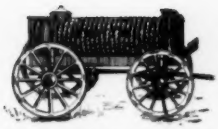

Wyatt 225-gallon galvanized corrugated wagon tank. It took two horses to pull it.

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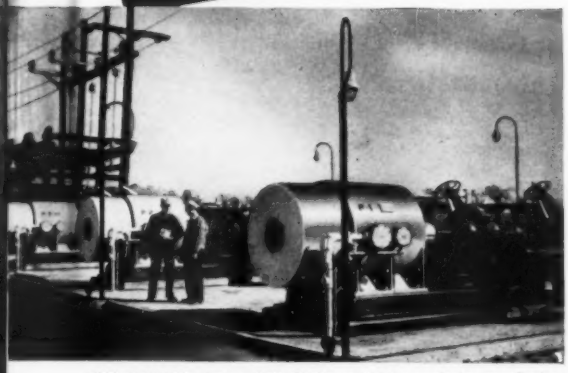
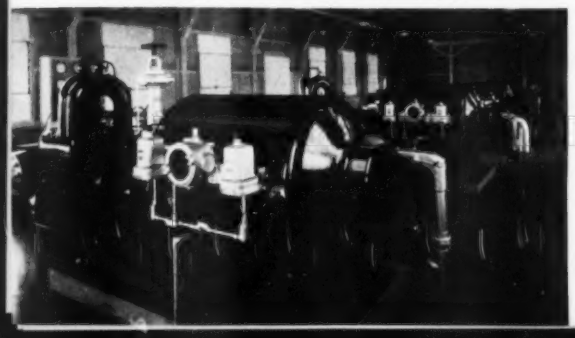


OUTDOORS: Three Allis-Chalmers 600 hp explosion-proof tube-type motors at the Baytown, Texas, installation of the Humble Oil Refining Company.

INDOORS: Allis-Chalmers 400 hp explosion-proof, tube-type motors "on-the-job" in a Sinclair Refining company pipe line station.



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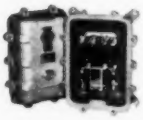

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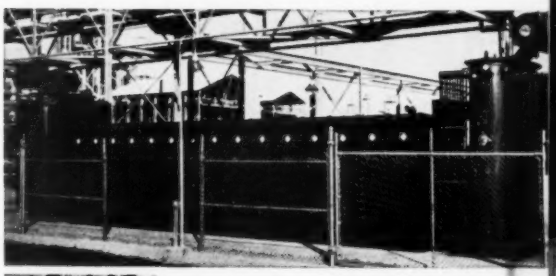

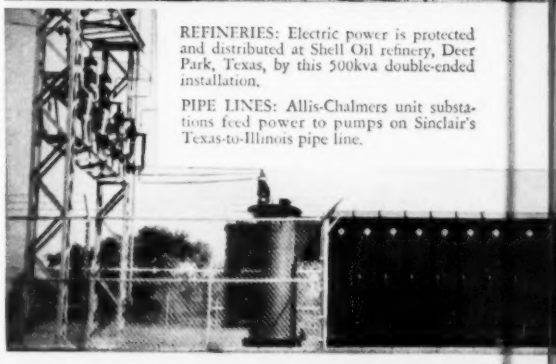

REFINERIES: Electric power is protected and distributed at Shell Oil refinery, Deer Park, Texas, by this 500kva double-ended installation.

PIPE LINES: Allis-Chalmers unit substations feed power to pumps on Sinclair's Texas-to-Illinois pipe line.

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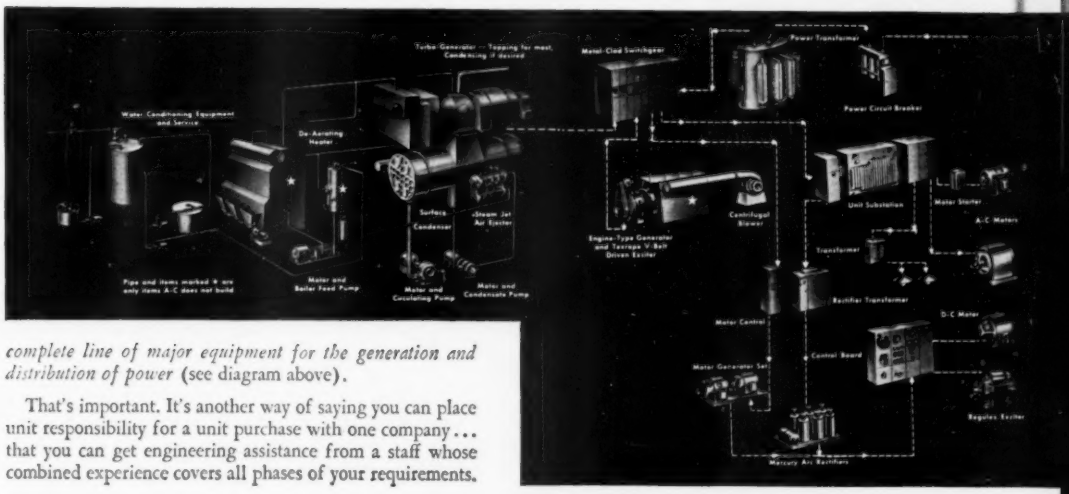

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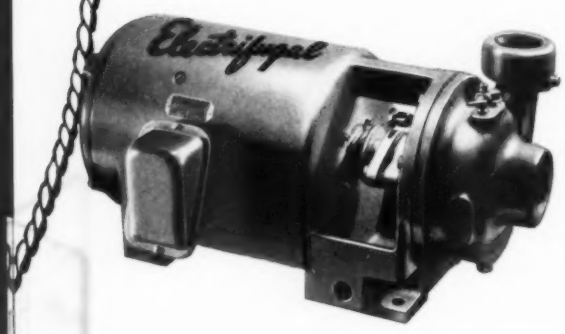

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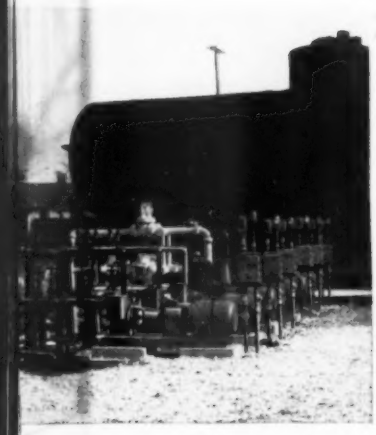
For information on SELF-PRIMING pumps for unloading tank cars, barges, tankers and storage tanks, write for bulletin 08B6319B.



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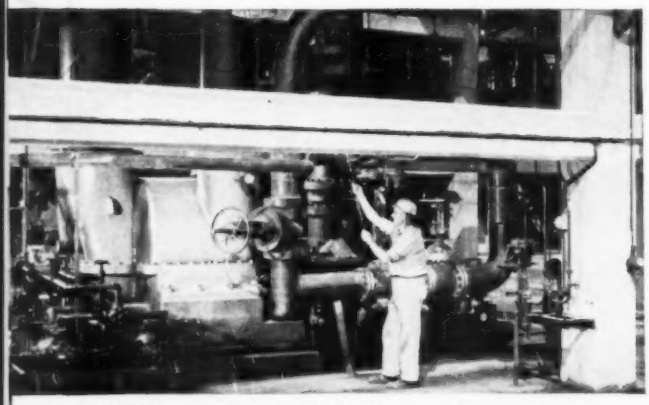
FOR THEIR CONTINUOUS fluid catalytic cracking process, Cities Service, Lake Charles, La., depends on seven Allis-Chalmers centrifugal blowers for catalyst aeration. They're rated 22,500 cfm, 17 lb G at 5100 rpm.

Six of the seven were installed in 1943. Two proceeded to set a record of 540 days, 24 hrs a day, continuous operation, being shut down only for drive inspection! Two others ran for 562 days before scheduled inspection shutdown! Only routine maintenance has been required on all seven to date.

These blowers are still on the job, 24 hrs a day, helping produce gasoline for the widespread operations of Cities Service. Output is at constant volume, automatically maintained by variable speed 2200 hp steam turbine drives.

Find out how this highly dependable, low maintenance air and gas handling equipment can work for you. Call your nearest A-C office or write Allis-Chalmers, Milwaukee 1, Wis.



WORKING "AROUND THE CLOCK" at 85 revolutions per second, Allis-Chalmers blowers set an impressive performance record at Cities Service Refinery.

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AT THIS MIDWEST PLANT, high hardness, the presence of silica, high boiler pressure and temperature, and the absence of condensate combined to make a tough water treatment problem. The Allis-Chalmers solution to this problem reduced water hardness to zero and cut silica content to less than 1 ppm!

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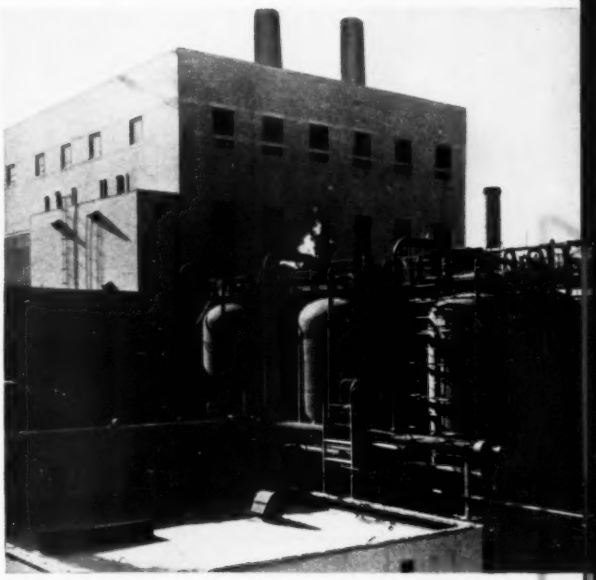

THIS Allis-Chalmers hot process system consists of six sedimentation tanks, twenty-four filter tanks, and allied mixing tanks, proportioners and control.

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continue to prove "in the field" that they have what it takes for high capacity slush pump drives . . . also widely used in the petroleum industry for compressor, generator and auxiliary drives. Below is a typical mud pump application. *Texrope* drives are the original multiple V-belt drive, and are available in the world's largest range!

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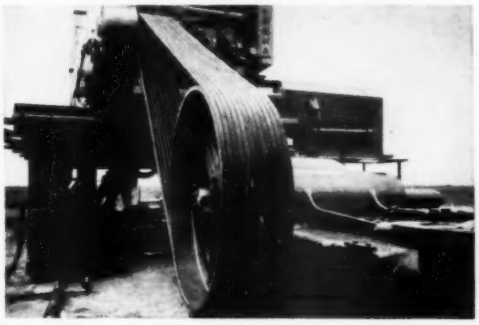

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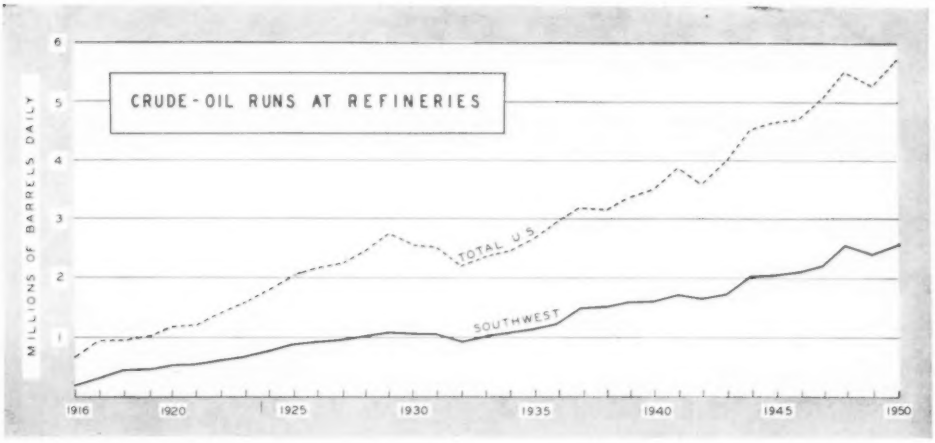


to use the early pipe-still designs. These were largely modeled after the Heine boiler design for steam generation. Later the pipe still was used to preheat crude before it passed to the first shell still for further distillation and fractionation. By the middle twenties the pipe still was operated independently of shell stills and took over most of the distillation operations at refineries.

Cracking

Reports show that starting in 1910 some of the larger refiners began investigating a new art in refining which in a few years came under the common designation of "cracking." Among the smaller refiners there were rumors that their big competitors had devised methods of greatly increasing the output of gasoline and kerosine from crude oil.

In 1913 Standard of Indiana made known, in part, the development of the Burton cracking process. The first unit was installed at its Whiting, Ind., refinery. The company at that time began to offer what was termed a "synthetic" gasoline at prices which were lower than the going market for straightrun gasoline.

Briefly described, the Burton operation and other early-day cracking processes consisted in application of high pressures and high temperatures in the distillation of gas oil and other heavy fractions of crude oil in the production of products coming within the range of gasoline and kerosine. The processing objective "to break up the heavier hydrocarbons of crude into the lighter hydrocarbons" had a special appeal to those interested in research, and several research and development laboratories of the Southwest had their beginning at that time. Various processes became available over a period of 10 years and differed mainly as to temperatures, pressures, and time used with other perfections in design to come later.

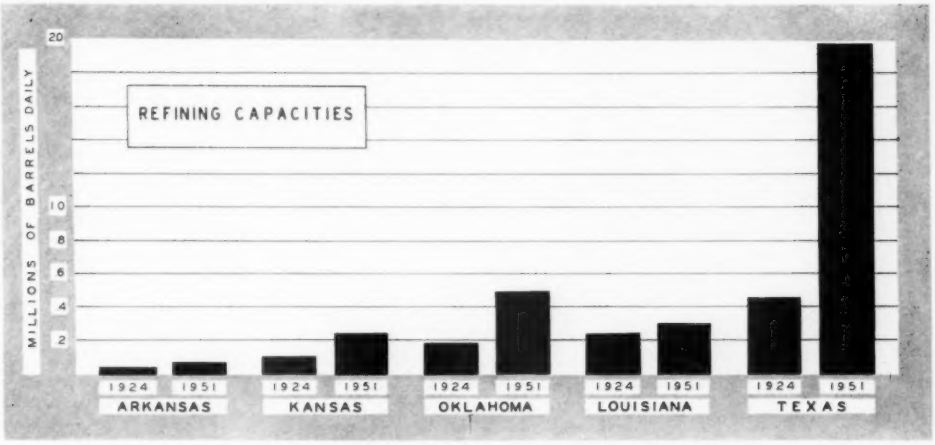
Some of the larger companies developed their own processes such as the Holmes-Manley of The Texas Co. This bore the name of R. C. Holmes, who later became president of The Texas Co., and F. T. Manley, who was for several years vice president in charge of all refinery operations of the company. The first units were placed in operation at Port Arthur in 1920.

At the same time, there was a rapid development of commercial processes by several concerns and these became available under license arrangements for all refiners in the Southwest. The most widely known of these were the Dubbs, Cross, and Jenkins.

Burton.—The original Burton process consisted of shell stills of 200 to 250-bbl. capacity which were operated by the batch method. The stills consisted of ½-in. steel; from the top of the still were long runbacks which were not insulated and which returned any uncracked fractions to the cracking zone. The original stills were operated at 35 lb. pressure and temperatures up to 750° F. In a 48-hour operation a 50 per cent yield of 48° to 52° distillate was obtained. Many changes were made over a period of 10 years from the original still to provide for continuous operation of batteries of stills. Later the shell still was replaced by a tubular still of Clark design.

The first southwestern units of the Burton process went on stream at the Neodesha, Kans., refinery of Standard Oil Co. in 1916.

Dubbs.—The Dubbs process had the widest application in southwestern refineries. The



application for patents of Jesse A. Dubbs dated back to 1909 and the patent for the original Dubbs process was issued in 1915. This patent was the basis for a suit by Universal Oil Products Co., owners of the Dubbs process, against Standard Oil Co. of Indiana, based on the alleged infringement in the operation of the Burton process. This became one of the most famous suits in the history of the petroleum industry, involving the taking of thousands of pages of testimony over a period of 20 years. Other processes also became involved in widespread patent litigation which extended through to the thirties.

The first units of the Dubbs process were installed at the Arkansas City, Kans., refinery of Moore Refining Co. in 1923.

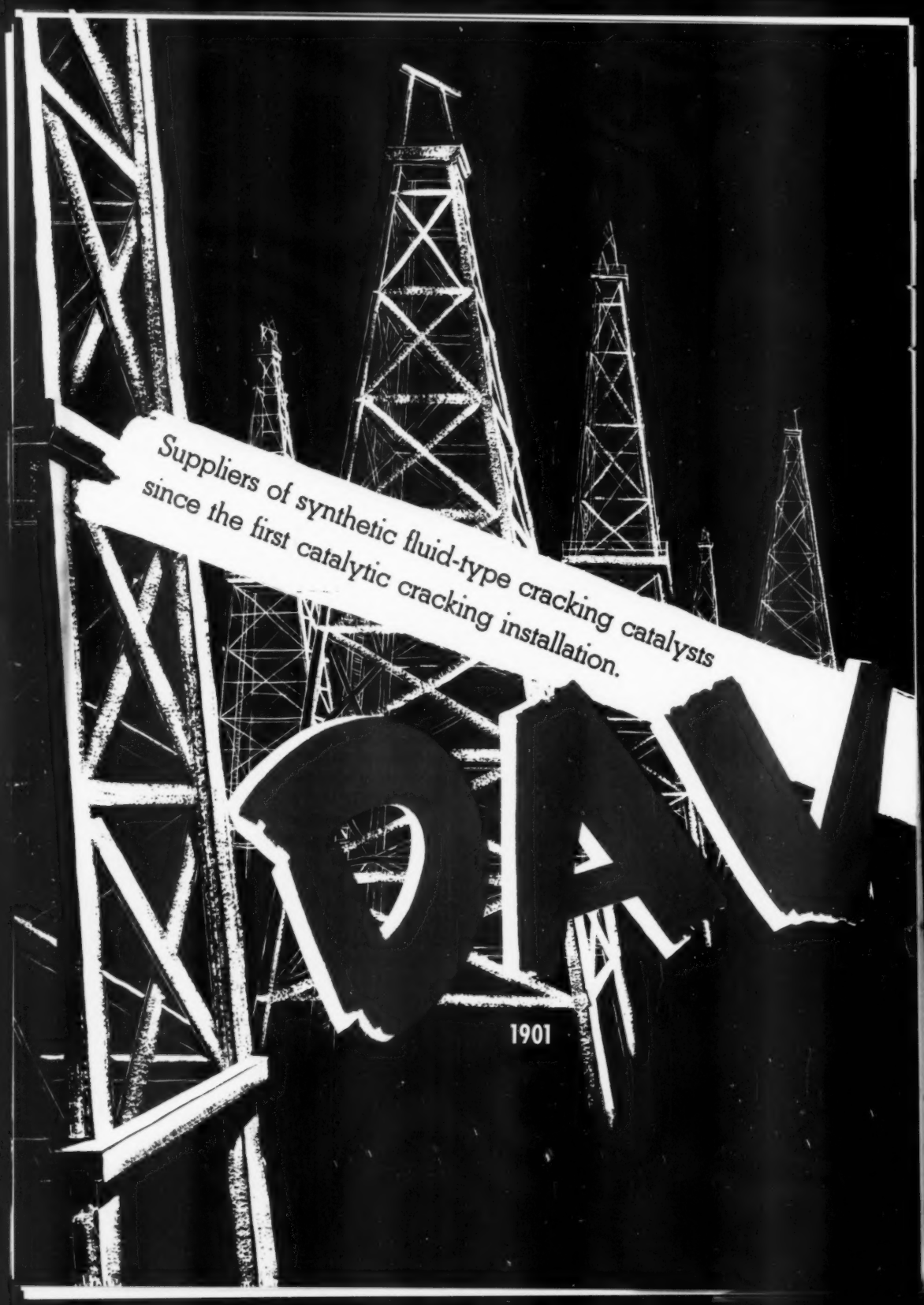
A description of the early-day Dubbs operation appearing in The Oil and Gas Journal. explained:

"The raw charging stock to be converted into gasoline and coke, whether gas oil or fuel oil, was pumped to the dephlegmator or directed to the heating element within a furnace or both. The temperature of the raw oil was raised to 820° to 900° F. under a pressure of upwards of 200 lb. The heated oil under heat and pressure passed into the reaction chamber and as a function of the temperature, was vaporized and also deposited some coke in the chamber. The vapors passed out of the reaction chamber through a pipe connection to the bottom of the dephlegmator wherein the heavier portions were condensed to a liquid while heat was interchanged with the raw charging stock.

"The mixture of raw charging stock and reflux condensate oil passed downwardly to the suction side of a hot oil pump, and was then pumped through the heating tubes where the oil was raised to the cracking temperature under prevailing pressure conditions. The uncondensed vapors in the dephlegmator passed out through the top to a condenser coil and were recovered as a distillate to be rerun. The pressure on the system was controlled by means of a gas-release valve on the receiver. The excess gas over that necessary to control the pressure on the system was passed either through a scrubber with the gas dissolved in the pressure distillate or burned. The temperature control of the dephlegmator was of such a character that a distillate of any end point could be produced continuously. When the operation was outlined to produce a residual oil the control valve in the bottom of the chamber was partially opened so that the residual oil could pass to storage."

Cross.—The Cross process, which was also widely used in Southwest refineries, was developed based on the research work of Roy and Walter M. Cross, brothers, who operated the Kansas City Testing Laboratory at Kansas City, Mo. The Cross process operated at higher temperatures and pressures than did most of the other processes of the early days. The temperatures ranged up to 900° F. with pressures of 600 psi. The process operated with a clean gas oil and the normal conversion was about one-third of the charge. The large reaction chamber caused a lot of comment among refiners at that time. The chambers varied in size with walls up to 3 in. in thickness.

Holmes-Manley.—The Holmes-Manley process was quickly installed at several southwestern refineries of The Texas Co. By 1928 the company had 150 units in operation at its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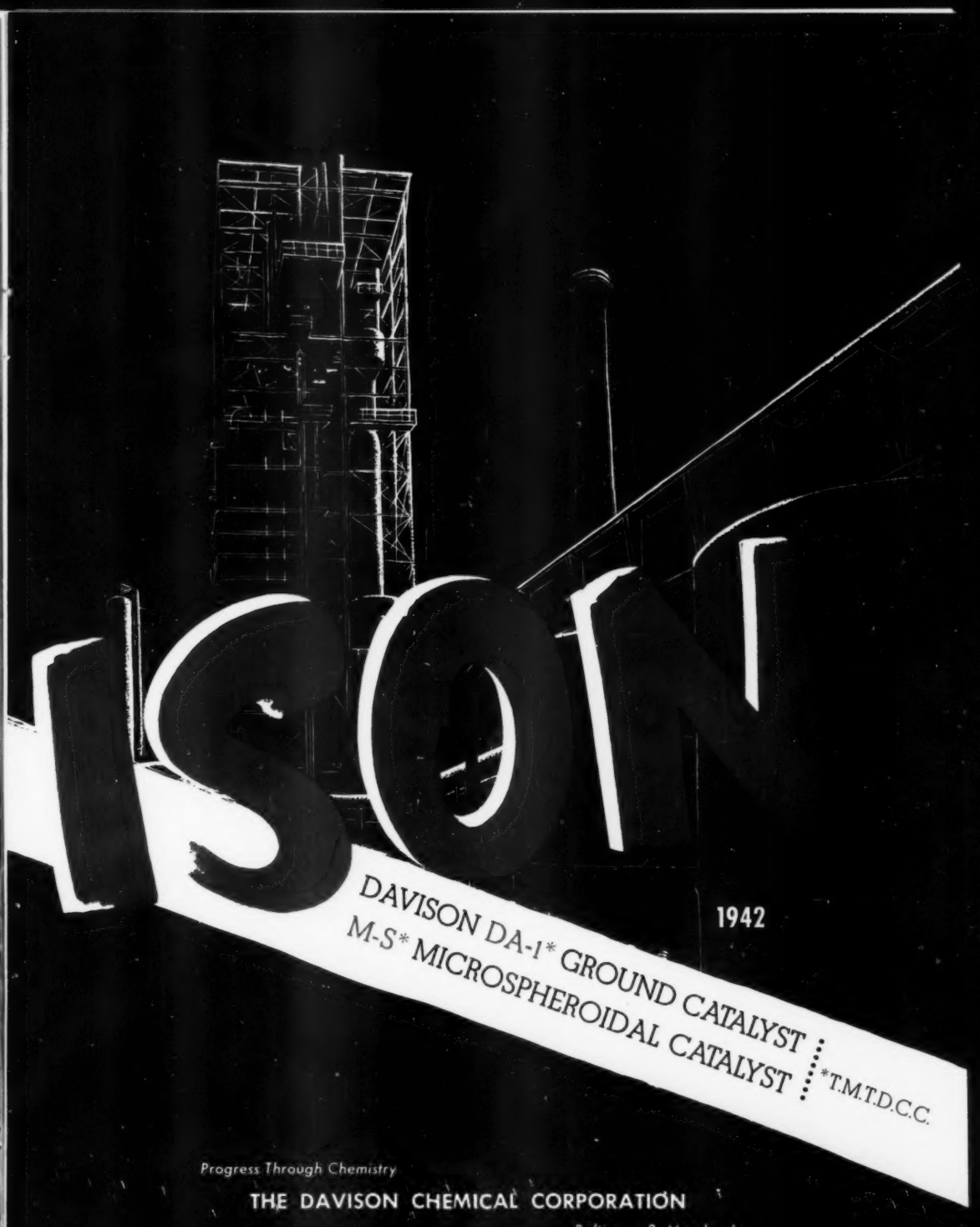

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domestic refineries. The operation was continuous. The unit employed a coil heater for preheating the feed which entered four reaction chambers in series where the bulk of the cracking took place. The vapors were fractionated to secure gasoline and unconverted fractions were returned to the unit for recracking.

During the war, the federal Government offered the Rittman process which had been developed through research work of the Bureau of Mines. In this operation the cracking took place in the vapor phase. This operation, which never received general approval, was tried out in at least two southwestern plants. The Jenkins' process had installations at southwestern refineries.

While the mixed-base crudes contained asphaltic materials not present in the Pennsylvania crudes, a few southwestern refiners, starting about 1910, found they could secure satisfactory lubricating oils from such sources as Glenn and Cushing pools. The operating procedure in general was the same as that used at eastern refineries.

At the same time the large Gulf Coast refineries and plants on the Atlantic seaboard, using Gulf Coast crudes, began to manufacture lubricants from the naphthenic-base crude oils. These lubricants, varying in viscosity and other specifications, gave satisfactory service in industrial and other uses.

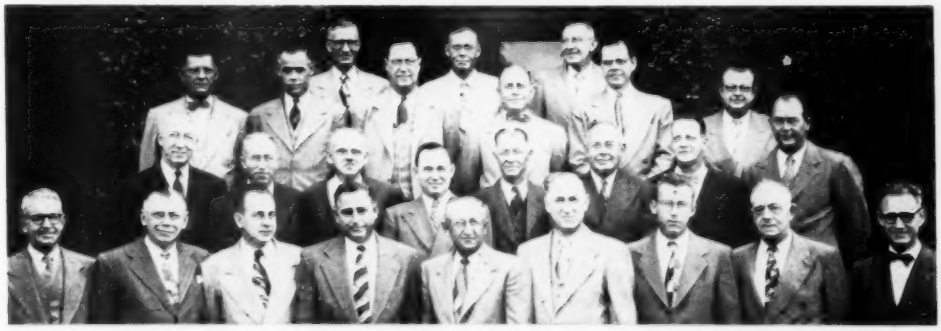
Gradually, starting in the twenties, some of the improvements in lubricating-oil manufacture began to be installed at the few southwestern refineries which had facilities to manufacture the oils. A high-vacuum process, known as the Schulze, was installed at the Houston refinery of the Deep Water Oil Refineries, Inc.

Also in the early twenties the Sharples centrifuge method in dewaxing was installed at the Ponca City, Okla., refinery of Marland Refining Co. (now Continental Oil Co.). Walter Miller, a widely known figure in eastern and later Oklahoma refining, was manager of the plant at the time.

Southwestern refiners began using contact filtration in their lubricating plants when that method became known, including the use of the first acid-treated clays. The Tulsa refinery of Mid-Continent Petroleum Corp. is credited with receiving the first carload of "Filtrol" prepared clay in 1926.

The twenties brought major changes in southwestern refining as it did all other parts of the country. As previously explained, by 1920 it was apparent the refining industry was overbuilt in several parts of the Southwest. Many of the skimming plants that had been built during the 1910-1920 period were shut down permanently.

The owners of the remaining plants had the problem of operating their plants profitably at substantially lower prices for finished products which resulted in lower plant realizations. There was a rapid adoption of the pipe still for all types of distillation operations. Fractionation was greatly improved so that many of the rerun procedures of the past were no longer necessary. The capacities of all types of operations were greatly enlarged. During



The growth in southwest refining has centered around the contributions of highly trained personnel. This group, in charge of the Texas City refinery of Pan American Refining Corp., reflects the scope of activities at a modern refinery and the training of the men in charge of the various departments. (Bottom row) E. W. White, mechanical; H. T. Rogers, construction and maintenance; W. A. Sullender, catalytic and distillation; R. H. Koehler, design and development; H. Baumel, night superintendent; P. A. Stewart, thermal cracking; W. T. Herget, petroleum chemicals; L. O. Griffith, night superintendent; B. E. Abercrombie, utilities. (Second row) R. H. Price, research and development; P. E. Darling, engineering; P. L. Brandt, chemical research; S. B. Schapiro, administrative; W. F. Schneider, marine; Harold R. Snow, administrative; G. W. Moyer, light oils; M. C. Hopkins, research and development. (Third row) H. C. Reiniger, industrial relations; P. F. Miller, administrative; B. F. Babin, administrative; G. M. Dent, administrative; J. E. Kasch, chemical engineering; T. M. Frank, medical. (Fourth row) H. B. Williams, safety; M. L. Shaw, plant protection; T. T. Lemen, night superintendent.

Southwestern refiners were called upon to supply more than 50 per cent of the motor fuel for this and thousands of other planes during World War II. They also led the entire nation in the production of other war products.

At refinery gate of Ponca City plant, Cities Service Oil Co., after Pearl Harbor.

this period there were outstanding developments perfected by manufacturers in all types of heat exchange, instrument control, pumping, storage, and treating methods. All were designed to reduce operating costs and at the same time improve the quality of products.

Perhaps the outstanding development of the middle twenties was the introduction of tetraethyl lead as blending material in the manufacture of high-octane motor fuels. The fluid, originally made available on a restricted basis by Ethyl Corp. (General Motors Corp. and Standard Oil Co., N. J.) was introduced in the Southwest in the middle twenties. This resulted in a competitive situation which was largely responsible for the rapid expansion of cracking facilities in the Southwest starting at that time.

By 1927, 75 refineries in the Southwest had cracking installations with rated capacities totaling 534,750 bbl. By 1930, 94 plants in the Southwest had one or more cracking units with a total capacity of 817,150 bbl. This compared with installations at 186 refineries for the entire United States with a total capacity of 1,705,299 bbl. This steady growth continued through the remainder of the 50-year period.

As the cracking process improved it became an essential part of practically all refinery operations. Its general use tended to reduce the wide fluctuations of the past in refinery prices. Operated with the middle and residual fractions of the crude oil, it prevented a large excess production of gas-oil distillate and fuel oil and at the same time enabled refiners to keep up with rapidly increasing demands for gasoline.

One of the problems that had to be solved in connection with the expansion of cracking was concerned with chemical treatment. The early product was off color and had a heavy gum content. Much was accomplished by improved fractionation. In connection with this work, major credit goes to the engineering concerns including M. W. Kellogg Co., Foster Wheeler Corp., Lummus Corp., E. B. Badger & Sons Co., Arthur G. McKee Co., and Winkler-Koch Engineering Co.

The contributions that not only these companies but many other engineering and construction firms have made to southwestern refining cannot be overemphasized. Through their own research and development they are responsible for most of the advancements that have taken place in refinery arts culminating in the applications of the 1940's, including petrochemistry, which place petroleum processing in the forefront of all manufacturing.

These concerns have worked closely with the operating departments of refinery organizations and have aided materially in the solution of many problems with which both large and small refiners of the Southwest have been confronted over the past three decades. The availability of these services has enabled refiners not only to increase their efficiency but also constantly to improve quality of products which have in turn widened markets.

An early development which aided in solving the color and gum problem was the use of a Gray vapor-phase treating process. The first installation was made at the Bransdall, Okla., refinery of Barnsdall Refining Co. in 1924. The process, which was invented by Thomas T. Gray, was successful from the first unit, and a number of installations were made in the Southwest.

The first installation of the Winkler-Koch cracking process went on stream at the Duncan, Okla., refinery of Rock Island Refining Co. in 1928. Several installations at southwestern refineries followed within the next 10 years.

The general adoption of cracking resulted in more attention being given to metallurgical

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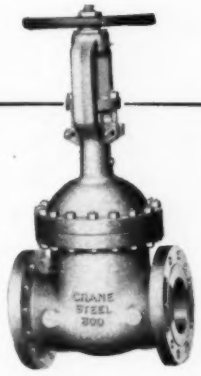

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Vapor Recovery

Another development, starting in the twenties, was the general installation of vapor-recovery systems. Previously few refiners made any systematic effort to protect themselves in the matter of evaporation losses either in the refinery operation or in storage facilities.

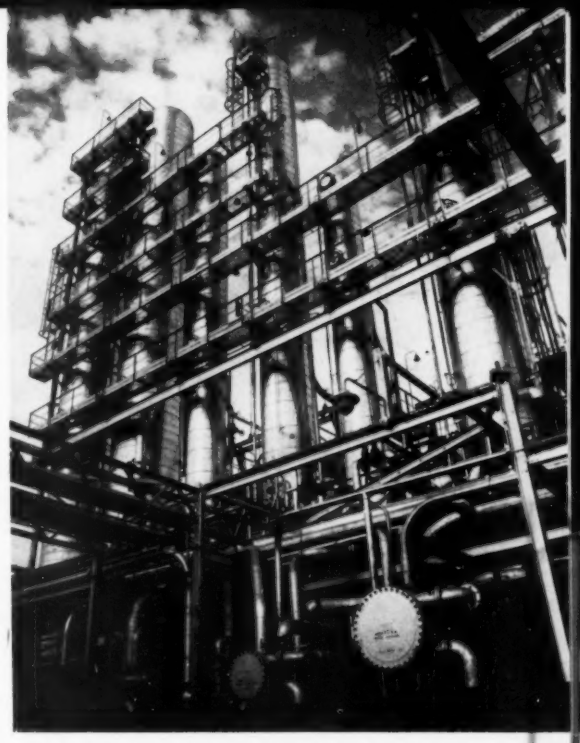
The expansion of cracking greatly increased the output of light hydrocarbons which were valuable not only because of their volatility characteristics but also because of the contribution they could make as blending material in the production of high-octane motor fuels. In the Southwest within a decade these vapor-recovery systems, closely resembling in design the natural-gasoline plants of the fields, were installed at all but a few refineries.

One result of this trend was to reduce the quantity of natural gasoline required by many refineries to maintain the volatility range of their motor-fuel output. It was not long until many refineries became entirely independent of natural gasoline as blending material and they were interested in the purchase of natural gasoline only when the product was available at prices several cents under the going market for motor fuels.

With the improved fractionation the vapor-recovery systems became producers not only of the ordinary grades of natural gasoline but they also became sources of supply for liquefied petroleum gases, including the propanes, butanes, and isopentanes. Later some of these light hydrocarbons were widely used in the production of war products and they were also the base for the rapidly expanding petrochemical industry.

The refining industry of the Southwest experienced the full effect of the depression period starting in 1930. Crude prices varied widely during the 1930-1933 period and were generally substantially lower than they had been in the twenties.

Starting in 1933 when crude prices were fixed under the national-recovery program, refineries generally were unable to maintain product prices in line with their new costs. This situation continued in the Southwest until in 1939 a recovery in refinery prices got under way and was extended in 1940 and 1941 so that plant realizations again became satisfactory. They were at these levels when all petroleum markets were frozen as a war measure in early 1942.



Alkylation became an important phase of petroleum refining with the start of the World War II program. These are the towers of the unit at the Smiths Bluff, Tex., refinery of Pure Oil Co.

Despite the unfavorable refinery market situation extending through most of 1930, a large amount of construction took place at both small and large refineries. Some of the smaller plants were practically rebuilt, pipe stills taking the place of shell stills for crude distillation.

In the case of the larger refineries this period saw the installation of distillation units having 10,000, 15,000, and 25,000 bbl. daily capacity replacing units whose capacities were measured in a few hundred or a few thousand barrels daily. The necessity of reducing operating costs because of the narrow margins on which to operate and the desire to improve quality of products were controlling in these trends of the thirties.

The octane ratings continued upward throughout the 1930's although refinery prices were still too low. Originally the use of tetraethyl lead as blending fluid in improving octane rating was confined to the premium grade. A representative octane rating in 1930-1931 was 65 for the regular grade, 52 for the third grade,

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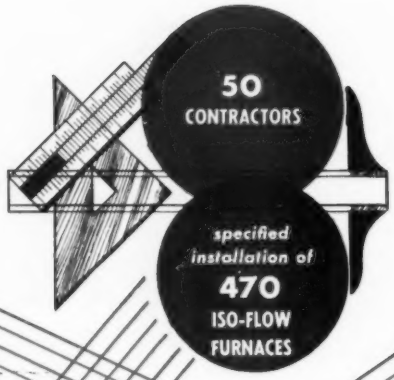

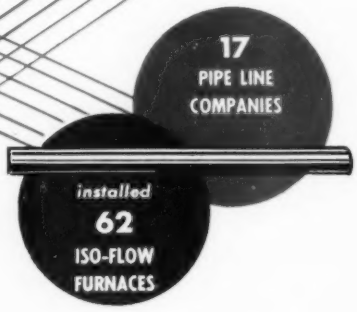

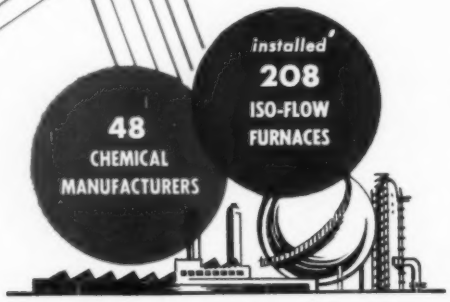

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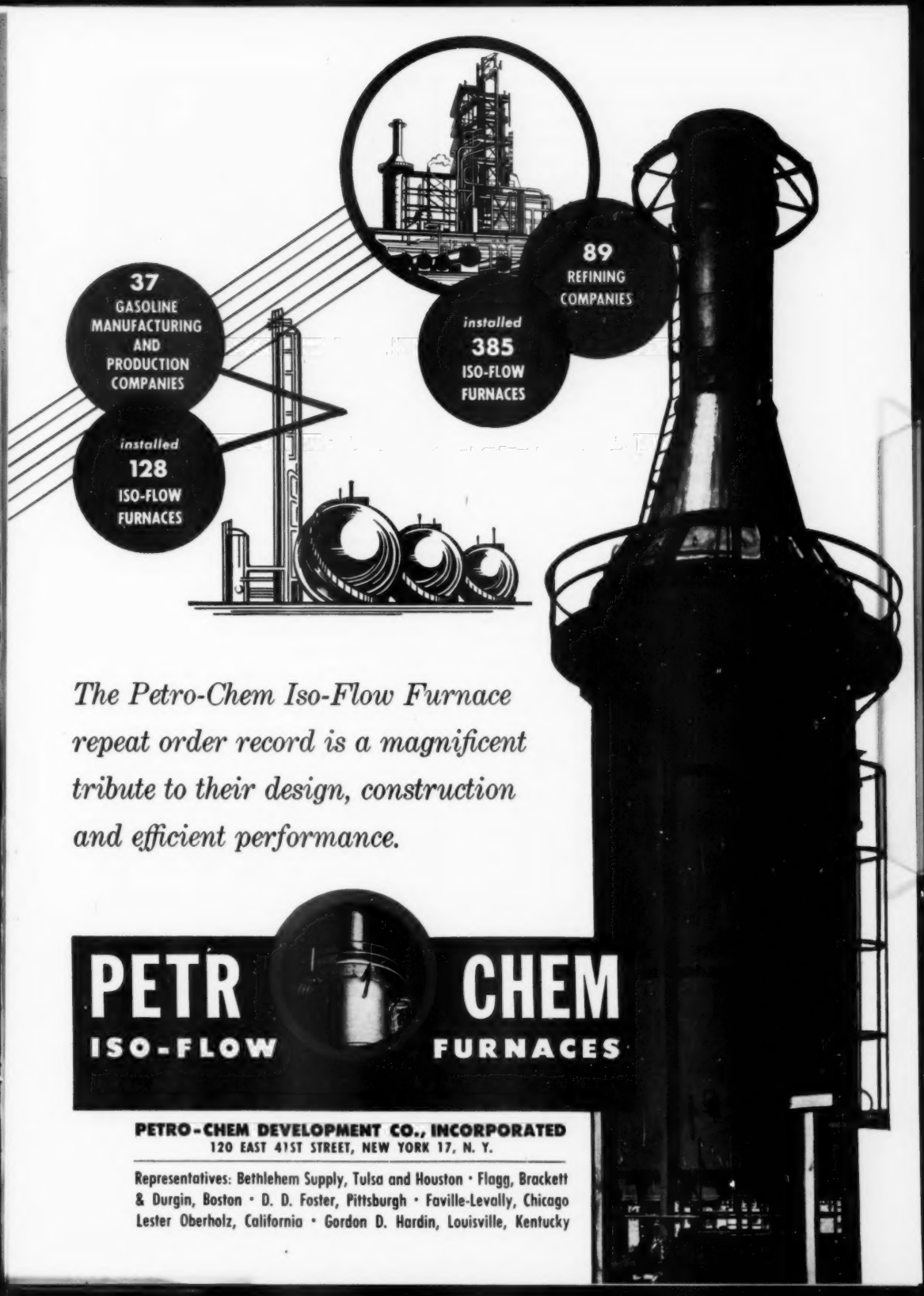

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and 72 for the premium grade. The third grade was a development of the depression in which refiners were called upon to make available a product which would give satisfactory performance in most cars and which could also be sold under the regular grade. Reflecting the steady improvement in motor-fuel quality, present octane ratings for regular and premium grades are 15 to 18 points higher than in the early thirties.

The first half of the 1940 decade in the Southwest was largely devoted to the expansion of facilities for the manufacture of war products. This included the rapid expansion of the new art of catalytic cracking which had been introduced in the late thirties, mainly at plants outside the Southwest. The new process gave larger yields of high-octane gasoline than did the thermal cracking process. It also had greater flexibility as to charging stock and produced greater yields of light hydrocarbons for further processing.

Alkylation and isomerization were introduced to process butanes from the refineries and natural-gasoline plants in the production of fractions with the highest octane ratings. New installations of that period, some of which were government owned, usually included catalytic cracking, alkylation, and isomerization operations. The net result was a large yield of fractions which could be utilized in the production of aviation fuels having an octane rating of 100 or more.

Following World War II, it became apparent that the catalytic cracking units and some of the other facilities could be adapted to peacetime operations, giving the owners a particularly strong position in the normal competition which was resumed in 1946. The octane race, so outstanding in the production of domestic gasolines previous to World War II, got under way again.

Probably the most important development of the postwar period so far as refineries are concerned is the increased demand for the middle products available from a barrel of crude. The percentage gain in the demand for distillates used for heating has been approximately twice that of gasoline. The result is that refiners generally in the Southwest have had to balance their operations with the knowledge that their winter demands for petroleum supplies would be greater than the summer demand.

The 1940 Decade

Developments in catalytic refining and solvent refining and growth in petrochemical processing are described later in this section.

Southwestern refiners have become a major source for lubricants in recent years. This is part of the packaging department of the Port Arthur, Tex., works of Gulf Refining Co.

Aside from these major contributions there was far greater progress in the application of refinery arts in the 1940-1950 period than in any previous decade in southwestern history. Practically all were the result of research and development which started earlier.

It is impossible to pick out any one of the more than 130 refineries operating in the Southwest during this period as typical. Methods of operation vary dependent on crude oils available, size of operations, and the products required by marketing departments. The main processing methods, however, do follow a general pattern and differ in types of applications rather than methods. Often two or more of these operations are combined.

(The remainder of this discussion dealing with representative operations of the 1940's is by R. B. Tuttle, of the Journal staff.)

Primary distillation of the crude-oil charges to the refinery usually is carried out separately in atmospheric units. Secondary separation is accomplished with vacuum distillation equipment. Other distillation operations are employed for fractionating broader cuts into narrower boiling range products.

In the over-all yield pattern of the typical complete refinery of the Southwest, straightrun gasoline is blended into finished gasolines. The

kerosine is marketed as such after being processed in treating equipment. Naphtha yield from primary distillation is separated into light and heavy fractions with the light portion often going to solvent production. The heavy fractions are subsequently processed for blending into the gasolines. The processing procedure for these three light products, gasoline, naphtha, and kerosine, may be varied as needed to meet current product demand, as for example a portion of the kerosine cut may be utilized in the manufacture of jet fuels.

The other products from primary distillation operations, distillates, gas oils, and residuum, are processed to produce diesel fuels, various heating oils, lube stocks, waxes, fuels, and road oils and asphalts. The bulk of gas oil and some of the heavier cuts from primary distillation are catalytically and thermally cracked.

All of the thermal processes have been modernized and balanced to meet the economic requirements of the refinery. The thermal cracking process is tied in with the catalytic cracking operation so that each is independent of the other as needed to balance out the current production pattern.

Reforming operations for the refinery include both thermal and catalytic processes. This combination provides sufficient flexibility for reforming any type of stock suitable for this kind of operation.

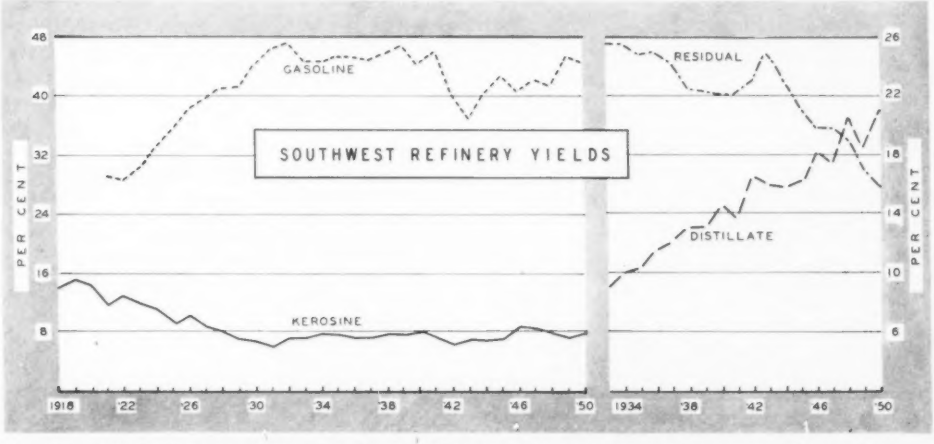
Most of the gas oil is utilized along with heavier material for charging stock to the catalytic cracker. Before the gas oil and the heavier material are blended, the latter is processed to remove some of the undesirable constituents of the oil by solvent extraction. This operation improves efficiency of the catalytic cracking operation by reducing the rate of carbon "laydown" on the catalyst. A portion of the gas oil and distillate stocks from primary distillation are subsequently processed to diesel fuels and burning oils.

The residual stock or reduced crude from primary distillation of the naphthenic base crude oils is processed to yield fuel oils and asphalts. Vis-breaking this heavy stock improves its pour point and viscosity over that obtained in primary distillation. When demand falls off for this type of fuel oil, the heavy stock may be further processed to yield feed stocks for cracking operations or it may be run to road oils and asphalts, depending on market conditions. Since vis-breaking may be utilized to lower the fuel-oil yield and increase gasoline production, the process provides the refinery with additional flexibility.

It is impossible to more than list the processing and treating methods which are used in the operations just described. Following are representative well-established operations to which could be added a number of other processes which were utilized in refineries of the Southwest during the last decade of the 50-year period.

CATALYTIC PROCESSING

Fluid Cracking	Isoforming
Thermofor Cracking	Polymerization
Houdriflow Cracking	Catalytic Reforming
Houdry Cracking	Dehydrogenation
Cycloversion Cracking	Sulfuric Acid Alkylation
Hydrogenation	Hydrofluoric Acid Alkylation
Hydroforming	Isomerization
Platforming	



Percentage yields at southwestern refineries have reflected changes in processing methods and market demands. Increased recoveries of distillate have been outstanding in recent years.

LUBRICATING-OIL PROCESSING

Duo-Sol	Solvent Dewaxing
Furfural Extraction	Wax Manufacturing
Phenol Extraction	Wax Fractionation
Propane Dewaxing	Chemical Desalting
Propane Deasphalting	Electrical Desalting

LIGHT OIL TREATING

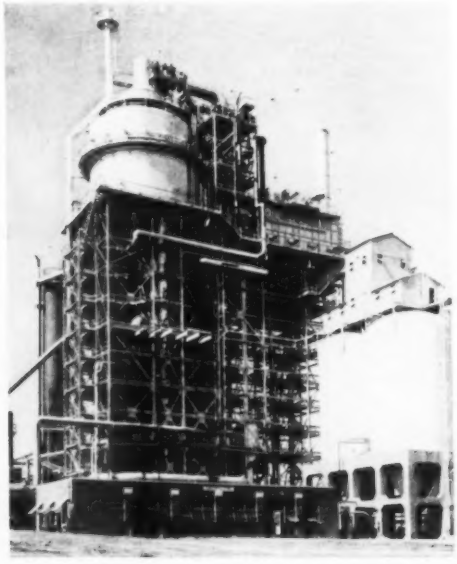
Perco Sweetening	Solutizer
Unisol	Girbotol
Mercapsol	Desulfurization

Catalytic Cracking and Solvent Refining Feature 1930-50 Period in Refining

by W. L. Nelson

THE refiner has always dreamed of being able to process any type of crude oil in such a way that variations in market demands or improvements in product specifications could, at will, be satisfied. This dream has almost become a reality in the Southwest during 1930-1951 largely through the development of solvent-extraction processes and catalytic cracking.

Vacuum distillation for the elimination of asphaltic material from dark-colored crude oils had been practiced for many years but in 1928-1930 vacuum distillation was converted into a highly successful process by the use of pipe-still heaters. This permitted the manufacture of lubricating oils from many crude oils that had theretofore been considered as unsuitable. Nevertheless, most of the lubricating oils produced in this manner were inferior in viscosity index or viscosity-gravity-constant compared with Pennsylvania lubricants. Accordingly, solvent extraction or treating processes were actively sought and by October 1933 a symposium before the A.P.I. revealed almost all of the solvent processes that are in use today.



Several independent refineries in Oklahoma and Kansas cooperated during World War II in the operation of this catalytic cracking unit at Duncan, Okla., now owned by Sunray Oil Corp.

By 1936, solvent-extraction plants of every kind were in commercial operation. Patents on furfural treating in 1925 led to experiments by The Texas Co. resulting in 1933 in an operating plant at Indian Refining Co. The chlorex process was developed almost simultaneously by Mid-Continent Petroleum Corp., Standard Oil Co. (Ind.), and several Pennsylvania refiners (1932-1935).

Leading processes in the United States in 1927 were the propane deasphalting, Duo-Sol, furfural and phenol processes, with the chlorex process running a close fifth.

Since 1930, the conventional methods of acid treating, clay contacting, etc., have been almost replaced or remain only as supplements to the solvent-treating processes (80 per cent by solvent treatment). Meanwhile, the daily solvent lubricating-oil capacity in the Southwest had risen to approximately 95,000 bbl. daily in 1950.

The removal of natural corrosion inhibitors, lubricating agents, etc., by solvent-extraction processes for a time was troublesome but these difficulties have now been surmounted by the development of additive agents which replace and are superior to the natural agents. The continual growth of the solvent-treating processes rests upon their cheapness, the feasibility of processing many variations of crude oils, coupled with the superior nature of the products with respect mainly to stability and viscosity index.

Catalytic Cracking

Although the yield of gasoline by thermal cracking is greater than by catalytic cracking or other processes for working up a crude oil, it has the now serious disadvantage of producing larger amounts of residual fuel than the catalytic processes. A major product of catalytic cracking is distillate fuel oil (cycle stock) rather than the residual fuel oil of the thermal processes. In addition, the average octane num-

1859 Col. Edwin Drake discovers oil near Titusville, Pa. Two years earlier William Graver had established his tank works at Allegheny, Pa.

1888 Graver moves to East Chicago, Ind., the first plant in the Calumet district.

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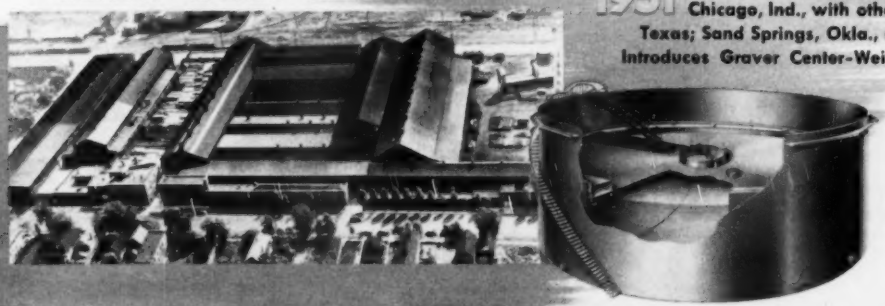

1951 Graver occupies large modern plant at East Chicago, Ind., with other plants at Houston, Texas; Sand Springs, Okla., and Catasauqua, Pa. Introduces Graver Center-Weighted Floating Roof ... the latest development in vapor-saving tankage.

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ber of the plant gasoline can be raised by catalytic cracking by about three units and in special cases even five units of octane number. If desired, premium gasoline of very high octane number can be produced in limited amounts.

Started in Southwest

Although the use of catalysts had been investigated even prior to 1900, and the usefulness of catalysts had been established, developments were hindered by deposits of carbonaceous material, etc., which stopped catalytic action after only a short time. The McAfee aluminum chloride process was studied extensively by Gulf Refining Co. between 1916 and 1922.

Dr. E. Houdry saw clearly that successful catalytic cracking rested more on the development of cheap and practical means of regenerating the catalyst than on the perfection of a catalyst. These pioneering developments of Houdry galvanized the oil industry into action regarding methods of handling and regenerating catalysts. The Hydroforming process which was used so extensively in World War II for the production of toluene was put into commercial operation in the Southwest late in 1940. It employs an aluminum-molybdenum catalyst in a fixed-bed arrangement, and hydrogen gas produced in the process is recirculated.

First Fluid Unit

Meanwhile, the highly useful principles of fluidization of powdered solids (or dusts) was being developed by Standard Oil Development Co. The first plant went into operation in the Baton Rouge plant of Standard Oil Co. of Louisiana early in 1942. The process was adopted by most of the major refiners during World War II, and thus the fluid catalytic cracking process rapidly surpassed the then dominant fixed-bed Houdry process. Accordingly, Houdry Process Corp. had currently been developing the Thermofor bucket elevator system of the Socony-Vacuum Oil Co., Inc., as a means of conducting continuous cracking and catalyst regeneration.

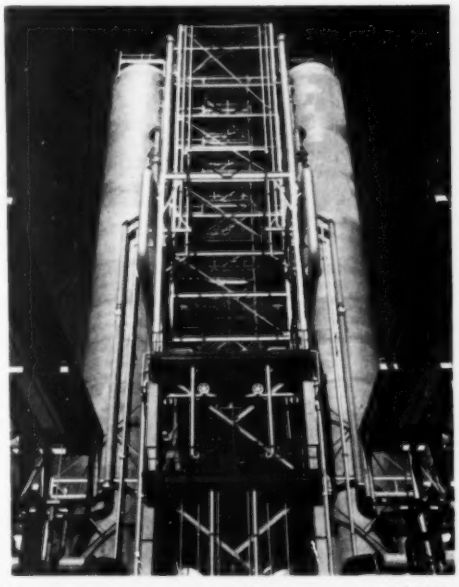
The first T.C.C. unit operated in the plant of the Magnolia Petroleum Co. at Beaumont, Tex., on October 11, 1943. The T.C.C. process has probably been more effective than other processes in handling high-boiling stocks. Their techniques for employing "liquid" and "partially vaporized" feeds were announced in 1945 and 1946 but no processes have succeeded in catalytically cracking residual or very high-boiling charge stocks. Cycloversion, a fixed-bed process using bauxite as a catalyst, was developed by Phillips Petroleum Co. and the first commercial plant operated in June 1944. Longer cracking cycles (2 to 10 hours) are possible than with other processes and the catalyst life is long.

The latest development in catalyst handling in the Southwest is the use of air (or gas) lift to elevate the catalyst in the Houdriflow system of Houdry Process Corp., and the T.C.C. process of Socony-Vacuum (1948-1949).

Finally, came the announcement in 1949 of the Platforming process of Universal Oil Products Co. The platinum catalyst is used as a fixed bed but as much as 40 bbl. of oil may be processed through a pound of catalyst without requiring regeneration. Hydrogen gas is produced and the octane number of the reformed naphtha is very high. Several units of this process are being installed at southwestern refineries.

The catalytic cracking techniques are usually associated with the oil industry, but they are important in themselves and are leading to revolutionary developments throughout the entire chemical industry. The catalytic cracking capacity in the Southwest for 1950 was approximately as follows:

	Operating capacity bbl. per day	Plants
Fluid	505,000	20
T.C.C.	120,000	7
Houdry	70,000	5
Houdriflow	5,000	1



These are the twin vacuum distillation towers at the $42,000,000 lubricating-oil plant of Cit-Con Oil Corp., Lake Charles, La.

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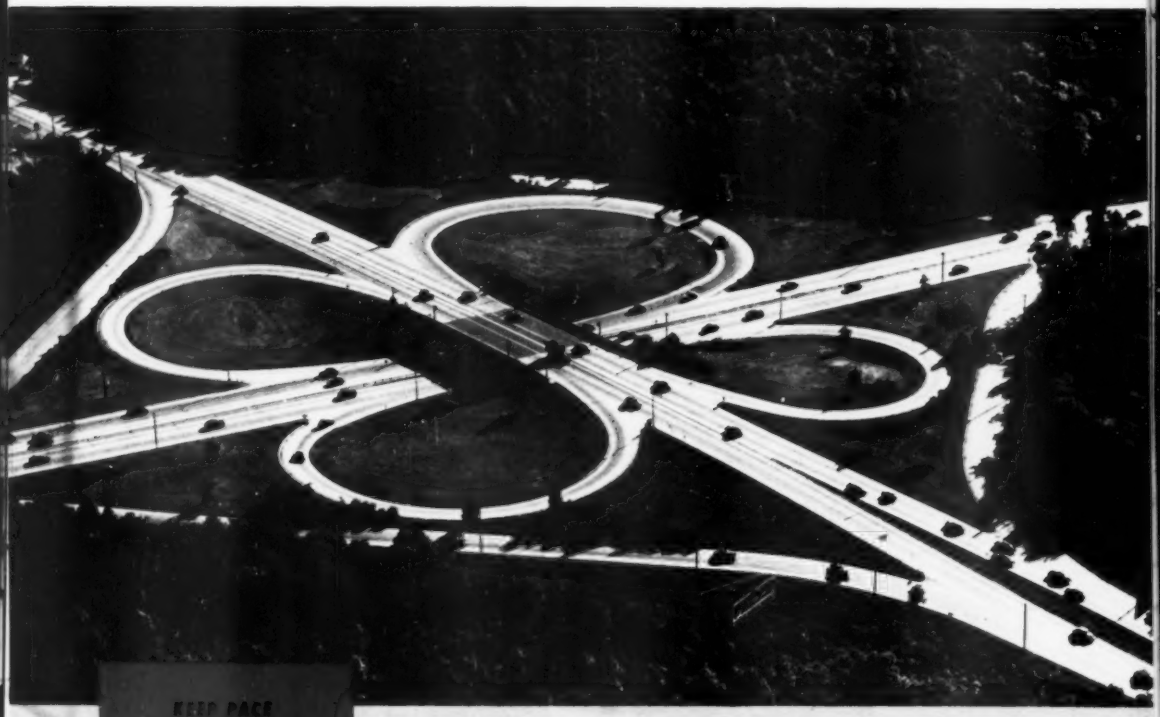

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Acrylonitrile, plastics, and synthetic rubber are among products of this multimillion-dollar Texas City, Tex., plant of Monsanto Chemical Co., which uses petroleum derivatives as raw material.

PETROCHEMISTRY'S WIDENING HORIZON

The Southwest got away to a late start in this important phase of the industry, but quickly roared into dominance, now boasting 85 per cent of nation's productive capacity

by George Weber

IN the Southwest, where over 85 per cent of current petrochemical productive capacity is now located, the first operations began in 1933. Commercial operations in other areas date back to 1920.

The pioneer in southwestern petrochemistry is Cities Service Oil Co. (Del.) and its predecessor companies. Investigations leading to the original discovery and subsequent development of the important controlled oxidation process were first undertaken by Empire Gas & Fuel Co. in 1924.

During that year, severe corrosion was first encountered when casing-head gas from Burbank field was introduced at a natural-gasoline plant at Tallant, Okla. Studies undertaken to find out what caused the corrosion and to correct it, revealed that the Burbank gas contained not only a high percentage of moisture, but also air, in concentrations up to 4 per cent—a combination promoting rapid rusting of line pipe and plant equipment.

A thorough evaluation was made of possible preventive measures. The most feasible proved to be one which would deoxidize the gas by combining the oxygen with light hydrocarbons present in the gas. To bring about this reaction, a catalytic process employing moderate pressures and temperatures was developed at research and field laboratories in Bartlesville, Okla., and Oil Hill, Kans. The original plant installation went into operation at Tallant on March 10, 1927, and the corrosion problem was solved at that point.

During development of the new process, investigators found that under the controlled conditions of oxidation, the reaction did not proceed all the way to form carbon dioxide, but resulted in the partial oxidation of hydrocarbons to produce aldehydes, alcohols, and other oxygenated chemicals. The commercial possibilities of this discovery were promptly recognized and research continued to develop conditions for optimum production of chemicals and for their separation and refining.

During the initial production period, the oxygenated chemicals were originally burned, and later were sold in crude state to the chemical industry. Meanwhile, work proceeded on the design and installation of refining facilities

Synthetic nitrogen is produced at the rate of 160,000 tons annually at the El Dorado, Ark., plant of Lion Oil Co., using natural gas, air, and water in its manufacturing operations. Other chemical products are manufactured.

at Tallant, and soon the company was producing its own finished chemicals and solvent blends.

For the next several years production of crude chemicals swelled with the expansion of the basic oxidation operation, and additional refining capacity was required at Tallant to keep pace with available charge stocks. During the early 1930's Empire built additional oxidation units at other Oklahoma natural-gasoline plants located at Maud, Sasakwa, and later at Oklahoma City. All crude chemicals were shipped to Tallant for finishing. At one time capacity of the Tallant plant represented about 30 per cent of the nation's formaldehyde production. The operation at Sasakwa was later discontinued but crude-chemicals production is maintained at Maud, Oklahoma City, and Tallant.

Today Cities Service produces a variety of chemicals and solvents. Formaldehyde in the conventional 37 per cent solution and concentrated paraformaldehyde in powder form, as well as acetaldehyde and methanol are produced as finished chemicals. In addition the company manufactures a line of methyl acetone-type solvents which have found wide industrial acceptance.

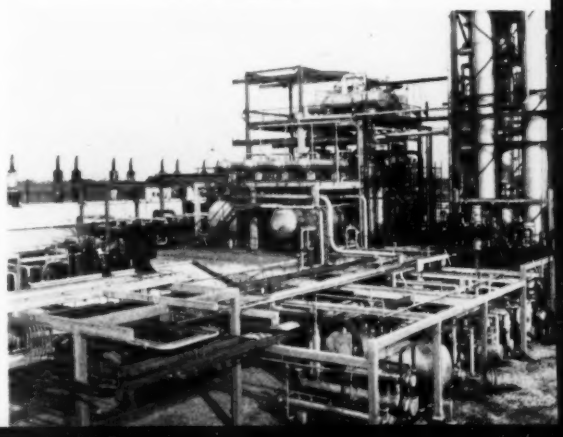
It was not until 4 years later after pioneering work began at Tallant, that petrochemistry was undertaken elsewhere in the Southwest. In 1937 following research work at the Baton Rouge refinery, Standard Oil Co. of Louisiana, a Jersey Standard subsidiary, commenced the first commercial production of naphthenic acids from selected refinery streams. This initial work was followed in 1941 by production of Perbunan, and during the war years the company participated with many others in the production of synthetic rubber basics. The most recent Baton Rouge contribution to the growing industry was the beginning of commercial production of isooctyl alcohol from olefins employing the "Oxo" process.

It was also in 1937 that Ethyl Corp. began the manufacture of tetraethyl lead at the new plant at Baton Rouge, employing lead, salt, and hydrocarbons from the neighboring Standard Oil Co. refinery.

Strong Beginning

The foundation of the present giant industry along the Gulf Coast of Texas and Louisiana was laid in 1941 when three important new petrochemical plants commenced commercial production. Carbide & Carbon Chemicals opened the new $15,000,000 plant at Texas City. Located adjacent to the 115,000-bbl. per day refinery of Pan American Refining Corp., this first major petrochemical plant in that region converted olefins from Pan American to a variety of alcohols, glycols, ketones, and esters.

This is the purification section of the ethylene unit of the petrochemical plant at Port Neches, Tex., of Jefferson Chemical Co. The company is owned jointly by The Texas Co. and American Cyanamid Co.



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This plant of Cities Service Oil Co. at Tallant, Okla., is the grand-daddy of the petrochemical industry in the Southwest. The production of chemicals originally was a byproduct of a natural-gasoline-plant operation.

Following a $15,000,000 postwar expansion program, this Texas City plant, one of four Carbide petrochemical units, now turns out tonnage volumes of methanol, ethanol, isopropanol, butanol, ethylene and diethylene glycols, acetone, isopropyl and butyl acetates, ethylene dichloride, ethylene amines, ethylene oxide, and acetic anhydride. In addition, literally scores of other chemicals are produced in less than tank-car lots.

Shell's Beginnings

Later in 1941, Shell Chemical Co., a wholly owned oil-company subsidiary, completed a $4,000,000 plant at Houston to produce isopropanol, acetone, and butadiene. Like the Carbide plant, it is located adjacent to a refinery, and receives all of its hydrocarbon raw materials from the 110,000-bbl. per day Shell refinery.

A third Gulf Coast chemical plant, also destined to be one of the largest in the country, saw initial production in 1941. Producing both inorganic and organic chemicals, the giant Freeport, Tex., plant of Dow Chemical Co. utilizes as raw materials, oil, natural gas, L.P.G., sea water, oyster shell, and salt. Among the more important petrochemicals produced at Freeport are: carbon tetrachloride, perchloroethylene, ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol, styrene, polystyrene, methylene chloride, ethylene dichloride, chloroform, and hexachloroethylene.

Prior to 1940 only five oil companies were engaged in petrochemical production on a commercial scale in the country. They included Jersey Standard, Cities Service, Shell, Pure Oil Co., and Standard Oil Co. of California.

During the war years a number of pure chemical companies also entered the Southwest, in most cases operating government-owned plants. Of those which later purchased such plants and became incorporated into the fast-growing petrochemical industry, Spencer Chemical Co. and Monsanto Chemical Co. are prominent. The Government's Jayhawk plant at Pittsburg, Kans., was purchased in June 1946 by Spencer Chemical for production of ammonia, ammonium nitrate, methanol, and dry ice. Shortly after, Monsanto purchased the Texas City styrene plant which the company had operated during the war.

New Oil Company Participation

During the same war period, other oil companies became firmly established in petrochemistry through operation of government plants. Of particular importance were Lion Oil Co. and Phillips Petroleum Co., which operate through chemical subsidiaries.

Operating the $28,000,000 Ozark Ordnance Works at El Dorado, Ark., Lion produced anhydrous ammonia from natural gas. The plant was leased by Lion in May 1946 and purchased outright in March 1948 by the company's chemical division. More than $10,000,000 was expended in adding facilities for manufacture of intermediates and finished fertilizers.

Through its wholly owned subsidiary, Phillips Chemical Co., Phillips now operates three Texas plants at Etter, Borger, and Houston. At the government-owned Plain plant at Borger, Phillips began producing butadiene in 1943. "Cold rubber" was introduced in 1947. In November 1950 the company took over operation of the adjacent government copolymer plant producing finished rubber from locally produced butadiene. Also at Borger Phillips

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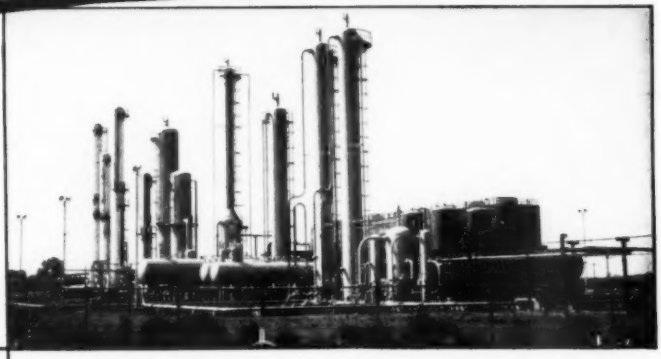

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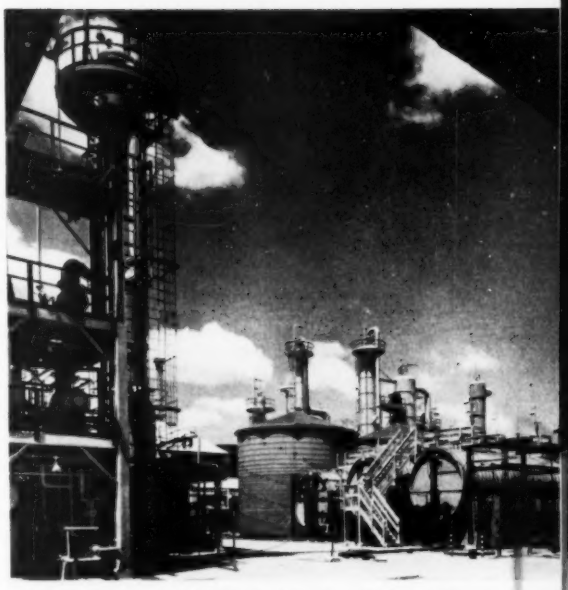
At Etter, Phillips produces 154,000 tons of fertilizers per year, including ammonia, nitrogen solutions, and ammonium nitrate. Ammonia from this plant is shipped to the newly constructed Houston installation where it is combined with sulfuric acid to produce ammonium sulfate.

Postwar Expansion

Among the prominent new postwar plants to locate in the Gulf Coast are those of such companies as Celanese Corp. of America, E. I. du Pont de Nemours & Co., Diamond Alkali Co., Ethyl Corp., Jefferson Chemical Co., Pan American Refining Co., and Rohm & Haas Co.

With $30,000,000 invested in the giant Chemcel plant at Bishop, Tex., and a $3,000,000 research laboratory at nearby Clarkwood, Celanese led the postwar parade of new petrochemical plants. Initial production began in August 1945. From controlled oxidation of natural gas, the plant produces five major tonnage chemicals: acetic acid, acetic anhydride, acetone, methanol, and formaldehyde. A number of other chemicals including alcohols, aldehydes, and glycols are produced in lesser amounts and at least 10 additional products are in various stages of laboratory pilot-plant and market-evaluation development.



This Houston plant of Shell Chemical Co. is credited with the first commercial synthesis of glycerin from petroleum.

Jefferson Chemical Co., jointly owned by The Texas Co. and American Cyanamid Co., began producing ethylene oxide, ethylene glycol, and ethylene dichloride in 1947. Diethylene glycol was added in 1950 and expansion now is under way to add monoethanolamine, diethanolamine, and triethanolamine to plant production by late 1951.

A major project now approaching settled production is the gasoline-synthesis plant of Carthage Hydrocol, Inc., at Brownsville, Tex. Byproduct chemicals from the gas-conversion process will be separated and concentrated by Stanolind Oil & Gas Co. for further chemical conversion and marketing by U. S. Industrial Chemicals, Inc. The 15 major chemicals to be derived from the estimated 300,000 lb. per day of water-soluble oxygenated chemicals produced at Brownsville presage the growing importance of future synthetic-fuel projects as major sources of organic chemicals.

COMPANIES PRODUCING CRUDE OR FINISHED CHEMICALS FROM PETROLEUM OR NATURAL GAS—GULF COAST AND SOUTHWEST

Company and plant location—

- Atlantic Refining Co.,* Atreco, Tex.
- Carthage Hydrocol, Inc.,‡ Brownsville, Tex.
- Celanese Corp. of America, Bishop, Tex.
- Cities Service Oil Co., Tallant, Okla.
- Cities Service Refining Co., Lake Charles, La.
- Continental Oil Co., Ponca City, Okla.
- Diamond Alkali Co., Houston, Tex.
- Dow Chemical Co., Freeport, Tex.
- E. I. du Pont de Nemours & Co., Orange, LaPorte, and Victoria, Tex.
- Esso Standard Oil Co., Baton Rouge, La.
- Ethyl Corp., Baton Rouge, La., and Houston, Tex.
- Gulf Oil Corp., Port Arthur, Tex.
- Hercules Powder Co., Houston, Tex.
- Humble Oil & Refining Co., Baytown, Tex.
- Jefferson Chemical Co., Port Neches, Tex.
- Lion Oil Co., El Dorado, Ark.
- Magnolia Petroleum Co., Beaumont, Tex.
- Mathieson Chemical Corp.,‡ Lake Charles, La., and Houston, Tex.
- McCarthy Chemical Co., Winnie, Tex.
- Merchem Co., Houston, Tex.
- Monsanto Chemical Co., Texas City, Tex.
- Natural Gas Odorizing Co., Houston, Tex.
- Neches Butane Products Co., Port Neches, Tex.
- Pan American Refining Co., Texas City, Tex.
- Phillips Chemical Co., Borger, Etter, and Houston, Tex.
- Rohm & Haas Co., Houston, Tex.
- San Jacinto Carbon Corp., Houston, Tex.
- Shell Chemical Corp., Houston, Tex.
- Skelly Oil Co., Eunice, N. M.
- Spencer Chemical Co., Pittsburg, Kans.
- Stanton Chemical Co.,† Corpus Christi, Tex.
- Texas Company, Port Arthur, Tex.
- Union Carbide & Carbon Corp., Texas City, Tex.

*Original petrochemical facilities under construction. ‡In conjunction with Stanolind Oil & Gas Co. and U. S. Industrial Chemicals, Inc. †Not operating.

SOUTHWEST Refining PERSONALITIES

Before 1901, southwest refining consisted of two small skimming plants. Today it is the dominating factor in domestic and world markets. Here are some of the leaders in management and technique responsible for this accomplishment.

H. B. Alspaugh, vice president of Rock Island Oil & Refining Co. and Wood River Oil & Refining Co., entered the oil industry in 1933 at Duncan, Okla. Before his present affiliation he was vice president of Rock Island Refining Co., now dissolved, and vice president of Rocket Oil Co., Duncan. He now resides in Wichita.

R. O. Anderson, president of Malco Refineries, Inc., and Fred M. Manning, Inc., Roswell, N. M., started as a ditch digger in 1938, and in 3 years had his own organization. Operations are in Texas, New Mexico, Wyoming, California, Mississippi, Colorado, and Utah.

Dr. I. Arthur Anson, Tulsa, left the presidency of Altitude Petroleum Corp. in 1933 to join Bell Oil & Gas Co., Tulsa. He received his doctorate from Columbia University. He is now vice president and manager of refining for Bell.

A. A. Ashworth was general manager of Kansas-Oklahoma Oil & Refining Co. and Alluwe Oil Co. In 1920 he became a partner in A. Beeby Thompson & Partners, specializing in refinery work and construction. (Died 1938).

D. P. Bailey, graduate of University of Texas, joined Standard Oil Co. (Ind.) in 1922. Later he joined The Texas Co., and is now assistant works manager at the Port Arthur, Tex., refinery. Bailey served with the Petroleum Administration for War during World War II.

Bonnar H. Barnes, Pittsburgh, joined Gulf Oil Corp. in 1921 as a chemist. He became general superintendent of Texas refineries, and in 1945 was appointed general manager of the manufacturing department in Pittsburgh.

Ralph Booker, executive vice president and general manager of National Cooperative Refinery Association, McPherson, Kans., started in Crawfordsville, Ind., as tank-wagon operator, and became a local co-op manager. He later became vice president of Rock Island Refining Corp.

Bruce K. Brown, Washington, D. C., president of Pan-Am Southern Corp., is deputy administrator of Petroleum Administration for Defense. An Illinois University graduate, he previously was associated with Standard Oil Co. (Ind.) and Petroleum Administration for War.

F. W. Burford, president of Sid Richardson Refining Co., Dallas, in the early 1920's was assistant sales manager for Skelly Oil Co. He later operated refineries in West Texas and North Louisiana before joining Richardson.

William J. Carthaus, Tulsa, has been with Deep Rock Oil Corp. for 20 years. He was elected vice president of manufacturing and research after having been assistant to the president.

H. H. Champlin was president and general manager of Champlin Refining Co., Enid, Okla. He established the First National Bank in Enid shortly after opening of the Cherokee Strip in 1893. (Died 1944)

R. T. Colquette, general manager of Pan-Am Southern Corp.'s El Dorado, Ark., refinery, formerly was a director and vice president of Root Petroleum Co. He was elected to the board of directors of Pan-Am Southern in 1950.

C. W. Cooper, manager of Pure Oil Co.'s Smiths Bluff refinery at Nederland, Tex., has been with Pure for 18 years. He is a member of the American Chemical Society and a past president of West Virginia Petroleum Association.

O. L. Cordell, president of Bareco Oil Co., Tulsa, was formerly manager of Oklahoma Oil Co. and vice president of Waite Phillips Oil Co. He became a vice president of Independent Oil & Gas Co. and later was manager of refinery operations and tank-car sales for Phillips Petroleum Co.

Howard A. Cowden, president and general manager of Consumers Cooperative Association and its manufacturing subsidiary, Cooperative Refinery Association, is a native of Pleasant Hope, Mo. The present firm, first organized under the name of Union Oil Co., Cooperative, is a general farm-supply cooperative.

L. L. Davis, Continental Oil Co., Ponca City, Okla., had been associated with Cities Service Oil Co. and Sinclair Refining Co. before joining Continental. Now manager of development of research, he previously was supervisor of technical services in the manufacturing department.

F. A. Deering, vice president in charge of refining for Kanotex Refining Co., Arkansas City, Kans., took his first job in the refining business as a timekeeper. He advanced through the ranks to lab tester and night superintendent, and became superintendent in 1924.

Roy J. Diwoky was assistant general manager of the Whiting, Ind., refinery of Standard Oil Co. (Ind.) before joining Pan-Am Southern Corp at New Orleans in 1949. He is now president.

Gordon L. Farned joined Humble Oil & Refining Co. in 1920. Now plants manager of manufacturing operations, he held the position of superintendent of the firm's Baytown, Tex., refinery before being named to his present post in 1943.

Harry W. Ferguson, Houston, director and in charge of refining operations for Humble Oil & Refining Co., received his Ch.E. degree from Michigan University in 1924. Joining Humble the same year, he was named manager of refining in 1945.

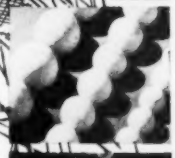
Philip E. Foster, who retired as manager of Shell Oil Co.'s Houston refinery in December 1950, began his career with the company in 1916 as a loader. Be-

ALCOA CHEMICALS

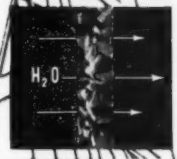
. . . partners in progress with the oil industry

During its brilliant 50-year history, the Southwest's oil industry has found ALCOA Chemicals make "good partners for good products." Remarkably versatile, these Aluminas and Fluorides have gone hand-in-hand with the Industry's progress—working wonders, increasing production, improving quality, reducing costs. They have a wide scope of beneficial applications. We'll gladly tell you how they can join you in a partnership that will make *your* future increasingly bright. ALCOA Aluminas are readily available. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 618E Gulf Building, Pittsburgh 19, Pa.

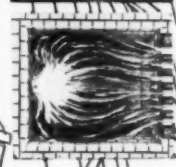
What catalyst does your reaction require? Granular, fluidized, sorptive, nonsorptive, porous, dense, active or neutral? There's an ALCOA Activated, Tabular or Calcined Alumina to up-grade your catalytic process yields . . . reduce losses from contamination and side reactions.



What are your bed-support and cover problems? ALCOA Tabular Alumina Balls are chemically and thermally stable and catalytically neutral. They offer economy . . . adaptability . . . better operation of your reactor towers.



What do you dry? How dry do you want it? ALCOA Activated Alumina is one of the oldest, most reliable, thoroughly proved desiccants in the petroleum industry for the dehydration of liquids, gases and vapors.



What temperature does your process require? Refractories fortified with ALCOA Alumina will withstand the highest temperatures . . . last the longest . . . resist spalling and corrosive slags and gases. And this performance *goes up* with the ALCOA Alumina content!

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ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

A Salute To The Oil Industry

In this 50th Anniversary year of Spindletop and The Oil & Gas Journal, we are glad to join in a salute to the progressive, patriotic oil industry of America and the free press that has accurately interpreted oil industry news during the past half-century.

Twelve years after the Lucas Gusher blew in, our electric service went to work in Spindletop Field. Today, all along the line, from well to consumer, Gulf States Power is utilized by the oil industry.

GULF STATES UTILITIES COMPANY

A BUSINESS-MANAGED, INVESTOR-OWNED, TAX-PAYING COMPANY

fore becoming manager of the refinery, he served as superintendent of the firm's Norco, La., plant.

J. M. Gardiner, president and director of Republic Oil Refining Co., Pittsburgh, entered the oil industry in 1918 with Atlantic Refining Co. He later went with Transcontinental Oil Co., and then with Republic. Elected president of the firm in 1950, he is also vice president and director of Duval Gasoline Co.

J. W. Glass, who was named superintendent of Socony-Vacuum Oil Co., Inc.'s, Augusta, Kans., refinery, first moved to that town in 1920 as assistant superintendent. He formerly spent 13 years at Casper, Wyo., as superintendent of the refinery there.

J. B. Hamblen, New Orleans, is general manager in charge of manufacturing for Pan-Am Southern Corp. He attended Wisconsin University and Massachusetts Institute of Technology, and had been associated with the research department of Standard Oil Co. (Ind.) before joining Pan-Am in 1935.

W. B. Hassett, retired, was prominent as a Mid-Continent refiner. Among his companies was Imperial Refining Co., Ardmore, Okla. A machinist by trade, he turned refinery specialist and later became head of Ohio Cities Co.'s refining department.

Ralph Clayton Holmes retired as president of The Texas Co. after having been associated with the firm since early days. He became superintendent of the company's first refinery at Port Arthur, Tex., and with **Fred Manley** developed the Holmes-Manley cracking process. (Died 1950).

Altis S. Hopkins, Neodesha, Kans., formerly president of Standard Oil Co. of Kansas, first entered the oil business in 1892. He joined Standard Oil Co. (Ind.) in 1897 and in 1913 was named superintendent of the Neodesha refinery. He was named president of Standard of Kansas in 1927, and remained in that post when the properties were sold to Indiana Standard.

R. R. Irwin, area manager for Socony-Vacuum Oil Co., Inc., at Kansas City, rose from roustabout to vice president and manager of the firm's White Eagle division. He now supervises refineries, pipe lines, and crude purchasing in the northwest-central states.

R. W. Jacobs, refinery superintendent for Panhandle Producing & Refining Co., Wichita Falls, Tex., graduated from University of Arkansas and began his career as an engineer with Texas Power & Light Co. He progressed to Orien Petroleum Co. as assistant superintendent, and became Panhandle superintendent of the Kingsmill, Tex., plant in 1932.

D. R. Johnson, manager of manufacturing for Continental Oil Co. at Ponca City, Okla., is a graduate of Colorado University. In 1924 he joined Continental and had been manager of the southern region prior to his present position.

R. L. Johnson, manager of Sunray Oil Corp.'s Duncan, Okla., refinery, has been with the organization since 1929, when Sunray bought the old Homaokla refinery, where Johnson was superintendent.

W. W. Keeler, vice president of the refining department for Phillips Petroleum Co. at Bartlesville, Okla., has been with the company since his graduation from Kansas University in 1929. During World War II he served with the Petroleum Administration for War.

G. R. Kinter, vice president in charge of manufacturing for Tide Water Associated Oil Co., Tulsa, has held his present position since 1949. In 1926, after 5 years as laboratory tester and superintendent of the firm's Burkburnett, Tex., refinery. He was named vice president of the Oklahoma-Texas pipeline subsidiary in 1934, and manager of manufacturing, Mid-Continent division, in 1937.

Fred B. Koontz, vice chairman of the board of directors of Mid-Continent Petroleum Corp., Tulsa, has been with the company since 1917. Prior to joining the firm he was associated with Standard Oil Co. (N. J.), Union Oil Co. of California, and Standard Oil Co. of California.

H. S. Lane, vice president of Crown Central Petroleum Corp., Houston, is also president of Crown Central Pipe Line & Transportation Co., Tidewater Pipe Line Co., and Cordele Pipe Line Co. He formerly was with American Oil Co. before joining Crown Central in 1931.

William J. Leenhouts, general manager of Johnson Oil Refining Co., Cleveland, Okla., is a graduate engineer. He joined Central Refining Co., Lawrenceville, Ill., as a chemist, and later went with Indian Refining Co. in 1921. Four years later he became general superintendent for Johnson.

George D. Locke was vice president of Barnsdall Refineries, Inc. After varied business experience, he became connected with Bigheart Producing & Refining Co., which Barnsdall absorbed. (Died 1942).

Benedict I. Lubell, Tulsa, executive vice president and general manager of Bell Oil & Gas Co., was connected with a New York law firm before entering the oil business. He attended Columbia University.

L. D. Mann, after 28 years with Cities Service Oil Co., was appointed vice president and general manager of Cities Service Refining Corp. at Lake Charles, La., in 1945. He was builder and operator of Maumelle Ordnance Works during World War II.

L. L. Marcell was one of the founders and chairman of the board of White Eagle Oil & Refining Co., later absorbed by Socony-Vacuum Oil Co., Inc. He was active as a producer in shallow fields of eastern Kansas before the state became a sizable producer. (Deceased).

Floyd L. Martin in 1930 joined Sunray Oil Corp. in Tulsa, and in 1935 became a vice president. In 1941 he was named a director, and is now executive vice president in charge of refining. He was assigned direction of producing properties in Santa Maria Valley and other Los Angeles Basin areas in 1950.

R. W. McDowell, president of Mid-Continent Petroleum Corp., also served as president of Black Hawk Oil Co. before its purchase by Mid-Continent. He has been a director of the American Petroleum Institute, and in 1949 was elected president of Western Petroleum Refiners Association.

E. A. Metcalf, manager of the Neodesha, Kans., refinery of Standard Oil Co. (Ind.), started his career as a pipe-line laborer in 1911. He went to the Neodesha plant in 1913, and has been there since that time, with the exception of 2 years served in the infantry during World War I.

J. L. Miller, superintendent of Shell Oil Co.'s Deer Park, Tex., refinery, began his career with the company in 1920. With exception of 4 years with the

Army, Miller has been continuously associated in various posts with Shell.

Walter Miller was vice president in charge of manufacturing of Continental Oil Co. A native of Switzerland, he came to this country and worked his way up to distinguished leadership. In 1943 University of Tulsa conferred on him an honorary degree as doctor of engineering. (Deceased).

P. M. Miskell was general manager of refineries for Empire Refineries, Inc. He began his career in Bradford field as a pipe-line worker. (Died 1935).

John W. Newton, director and vice president in charge of manufacturing for Magnolia Petroleum Corp., Beaumont, Tex., has been with the company since 1914. He is a chemical-engineering graduate of Texas A. & M. College.

Justus O'Reilly, El Dorado, Kans., superintendent of Skelly Oil Co.'s El Dorado refinery, graduated from Kansas State College in 1935 and joined the company shortly thereafter. He served as special assistant to the vice president in charge of manufacturing before being appointed to his present position.

Harold G. Osborn since 1921 has been associated with Continental Oil Co. at Ponca City, Okla. In 1950 he was named vice president in charge of manufacturing, stepping up from the manager's position.

E. E. Plumly was vice president of Magnolia Petroleum Co., Dallas. Entering the Olean, N. Y., refinery of Acme Oil Co. in 1896, his abilities led to prominence as a refinery expert. (Deceased).

L. W. Robbie, vice president and general manager of Republic Oil Refining Co., Texas City, Tex., started as an engineer with Universal Oil Products Co. before joining Republic Oil in 1947.

J. B. Rogerson, manager in charge of manufacturing for Lion Oil Co., El Dorado, Ark., joined the company in 1926, and formerly was with Allis-Chalmers Manufacturing Co. He was chief engineer and general superintendent for Lion before being appointed to his present position.

G. L. Rowsey, president of Taylor Refining Co., Taylor, Tex., entered the refining industry as a chemist. He is credited with new methods in treating light-oil products.

J. W. Schriever, superintendent at the Fort Worth refinery of Gulf Refining Co., started his career with the firm in 1915 at Port Arthur, Tex. In 1931 he was transferred to Cincinnati as assistant superintendent, and later to Sweetwater, Tex., as superintendent.

Karl W. Shimeall, vice president of refining for Crown Central Petroleum Corp., Houston, joined Continental Oil Co.'s Florence, Colo., refinery in 1916 after attending Colorado University. He left Continental in 1923 as assistant to the vice president of refining at Ponca City, Okla., to join Crown Central.

F. M. Simpson, Lake Charles, La., formerly general superintendent of the refining division of Cities Service Oil Co. (Del.), is vice president and general manager of Cit-Con Corp., Lake Charles. He joined a predecessor company to Cities Service following graduation from Texas A. & M. College.

E. J. Slater, vice president and general manager in charge of refining for Champlin Refining Co., Enid, Okla., has been in the oil industry since joining Kendall Oil Co. in 1906. He had also been associated with Texas-Mexican Oil & Refining Co. and Magnolia Petroleum Co.

Dr. H. R. Snow, vice president and manager of Pan American Refining Corp.'s Texas City, Tex., refinery, was formerly with Standard Oil Co. (Ind.), and Rubber Synthetics, Inc. A graduate of Michigan University, he is a member of American Chemical Society and American Institute of Chemical Engineers.

K. O. Stowell, Denver, entered the manufacturing department of Humble Oil & Refining Co. in 1930 following graduation from Colorado University. He later joined Deep Rock Oil Corp., and became refinery manager at Cushing, Okla. He left the firm in 1951 to become assistant to the vice president in charge of manufacturing for Bay Petroleum Corp. in Denver.

T. J. Sullivan, Gulf Oil Corp., Pittsburgh, is vice president in charge of manufacturing. He joined the firm in 1921 and served as general superintendent of Texas refining as well as general manager of manufacturing.

R. L. Tollett, president and general manager of Cosden Petroleum Corp., Big Spring, Tex., has spent his entire life in and around the oil fields. At 18 he worked with Panhandle Producing & Refining Co., and later became an attorney and certified public accountant. He has been president since 1940.

Temple W. Tutwiler was chief engineer and director of Cities Service Oil Co. He expedited construction of the Lake Charles, La., refinery during World War II, and was also an officer and director of several companies.

James W. Vaiden, vice president in charge of manufacturing for Skelly Oil Co., Tulsa, joined the organization in 1924 following graduation from Alabama Polytechnic Institute. He advanced from a laborer to line walker, stillman and plant chemist.

H. J. Voorhies, general manager of the manufacturing department of Esso Standard Oil Co. at Baton Rouge, La., has been with the Standard Oil Co. (N.J.) organization since 1922.

Dr. E. F. Voss, chief refinery engineer for Humble Oil & Refining Co., Houston, entered the oil industry in 1924 as a chemical engineer for Humble at Baytown, Tex., in 1924. In 1926 he was named chief refinery engineer at Baytown, and was transferred in Houston in 1929 as chief refinery engineer.

Frank L. Wallace joined The Texas Co. in 1919 in the power department at the Port Arthur, Tex., works. He became general superintendent of the refinery in 1939, and in 1943 was named works manager.

John S. Wertz, Wichita, had been with Kanotex Refining Co. before joining Vickers Petroleum Co., Inc., of which he has been president since 1947. He formerly was secretary-treasurer of Vickers.

G. E. Wynn, Tulsa, vice president in charge of manufacturing for Mid-Continent Petroleum Corp., joined the company in 1924 following graduation from Kansas University. He was placed in charge of the West Tulsa refinery in 1949.

D. A. Young, general superintendent for Sinclair Refining Co. at Houston, worked at East Chicago, Ind., and Marcus Hook, Pa., before being transferred to Wellsville, N. Y., as assistant superintendent, and later to Houston as general superintendent.

Where There's Oil—
There's A.O. SMITH!

After 47 Years of Basic Partnership in the Progress and Development of the Petroleum Industry, A.O. Smith Continues to Serve . . .

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...FROM CRUDE OIL

A. O. Smith Products Have Helped Provide Better Ways of Drilling,

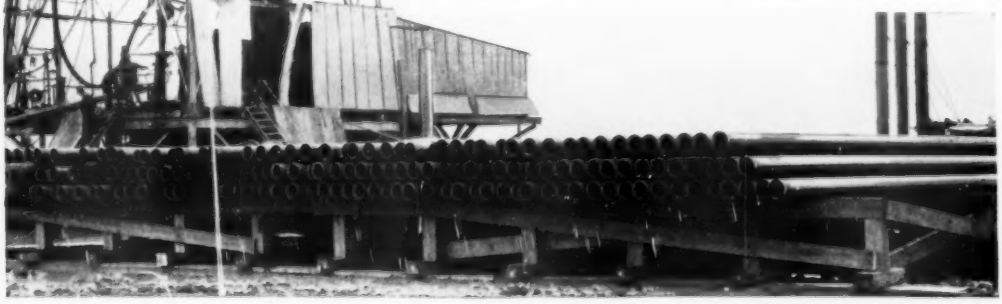
When oil spouted at Spindletop in 1901, heralding the discovery of a vast ocean of wealth underlying the soil of Texas and the Southwest, America acquired one of its most valuable economic assets. Yet, this great natural resource had no value to the nation until it could be made available to people in forms that were readily usable.

Making it available in the many ways that it now serves millions of people is the story of the progress of the oil industry. In that march of progress many companies made contributions both large and small. One that started playing its part almost from the start, and that has been adding more contributions ever since, is the A. O. Smith Corporation, which for 77 years has been a fabricator of steel products.

It was in 1903 that A. O. Smith made the first pressed steel automobile frame in American history. Within a short time, A. O. Smith was mass producing frames for Henry Ford whose revolutionary manufacturing methods were to send gasoline-burning vehicles throughout the civilized world. By 1920, finished frames were being turned out —light, strong and at low cost—at the rate of one every eight seconds. Today, A. O. Smith has

THE FOUNTAINHEAD of the oil industry is at the well. Here is where the black gold starts its flow to refineries. In the very drilling of the well, A.O.Smith plays its part by furnishing oil well casing and couplings.

REFINERIES throughout the world operate today with all-welded pressure vessels that were originated by the A. O. Smith Corporation.



TO THE CONSUMER

77th ANNIVERSARY 1874 - 1951

Refining, Distributing and Utilizing Petroleum Products

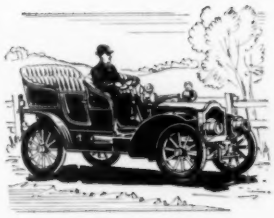
produced frames for 40,000,000 motor vehicles that have consumed billions of gallons of gasoline and untold quantities of lubricating oil and grease.

In the 1920's, using welding techniques which it had pioneered, the Company began the manufacture of casing couplings, line pipe, pressure vessels for oil refineries and, later, oil well casing. Since then A. O. Smith has produced a whole succession of products that have contributed to the progress of the oil industry.

In addition, in plants spread across the nation, A. O. Smith now makes:

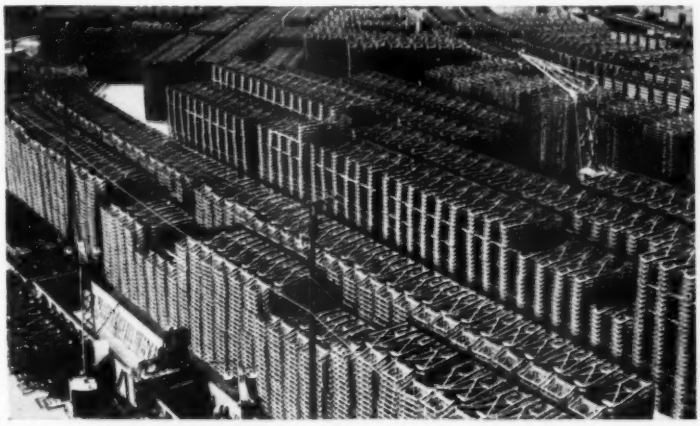
Meters that measure the flow of all liquid petroleum products.
Gasoline filling station pumps and the motors that activate them.
Domestic automatic water heaters that burn natural gas and LPG.
Liquefied petroleum gas systems.
Gas home-heating units.
Commercial gas water heaters.
Gas conversion burners.

Each of these products, the result of sustained research, has taken its place in the long range program in which A. O. Smith has served the petroleum industry.

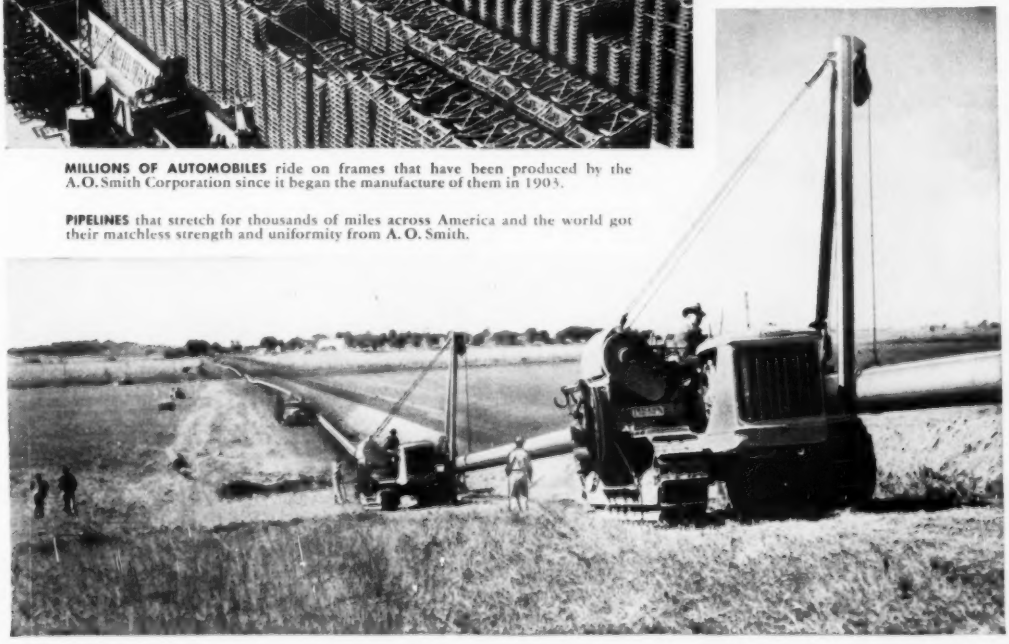


IN 1903, these "horseless carriages" were supported by A. O. Smith chassis frames.

IN 1951, after decades of engineering progress, the automobile industry still uses millions of A. O. Smith frames.



MILLIONS OF AUTOMOBILES ride on frames that have been produced by the A.O. Smith Corporation since it began the manufacture of them in 1903.



PIPELINES that stretch for thousands of miles across America and the world got their matchless strength and uniformity from A. O. Smith.

OIL WELL CASING

A. O. Smith Employed New Techniques to Produce Casing That Raised the Strength Standards of the Industry

The efficiency of oil well casing depends on two factors, both of which were solved by the A. O. Smith Corporation.

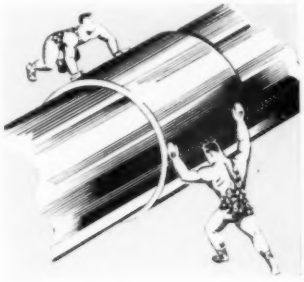
The 40-foot lengths of casing must resist tremendous external pressures. At the same time, the threaded couplings which hold the lengths of casing together must withstand tremendous internal pressures. At the joints the threaded portion of the casing is crowded inward, due to the pull of the weight of the "string," while this same pull forces the coupling outward. This sometimes causes the threads to jump out of engagement.

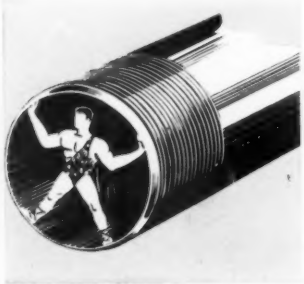
The problem here was to increase the resistance of the casing to external pressure while increasing the resistance of the coupling to internal pressure.

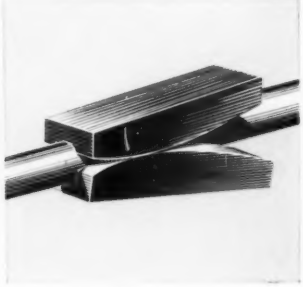
Applying many years of research to these problems, A. O. Smith produced, first, a welded coupling which after fabrication was internally expanded to the desired diameter. Internal expansion of a ring of steel increases the ring's resistance to internal pressure. It is simply a method of cold working steel. Later the Company applied the same principle to the casing itself, except in reverse. Here A. O. Smith produced a welded casing which it then cold compressed to the desired diameter. Cold compression increases resistance to external pressure.

Thus, A. O. Smith produced casing and couplings which (1) reduced the total weight of the "string" where the safety factor was satisfactory, (2) increased the safety factor where weight was not an important consideration, and (3) allowed greater depth settings without sacrifice of safety.

BETTER CASING was developed by A. O. Smith when, applying knowledge of metallurgy and welding, the Company produced casing couplings that possessed extra resistance to internal pressure (upper right), and casing that had added resistance to external pressure (below). This was done by methods of cold working steel. An example are the dies shown at lower right which accomplished the desired cold compression of the casing.







PRESSURE VESSELS

THE FIRST ARC-WELDED VESSEL—made by A. O. Smith more than 25 years ago—is still in operation at this installation in Port Arthur, Texas.

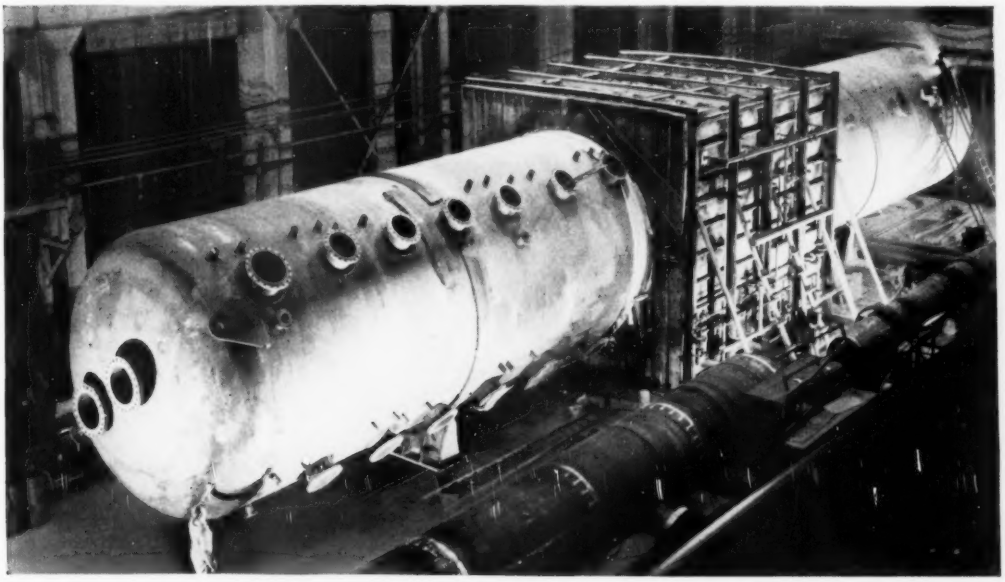
The First Electric Arc-Welded Vessel —Built by A. O. Smith—Set a New Pattern for the Refining Industry

In 1925, the development of petroleum processing was greatly accelerated when A. O. Smith built the first metallic arc-welded pressure vessel. This vessel and several like it were placed in service for The Texas Company at its plant at Port Arthur, Texas. Some of the units remain in operation even today.

The chief advantage of this achievement was that it permitted the manufacture of much larger and more complicated refinery vessels. This was important in the mid-1920's because demand for petroleum products was increasing at an unprecedented rate. Application of the welding technique to refinery equipment freed design engineers from many limitations that had existed.

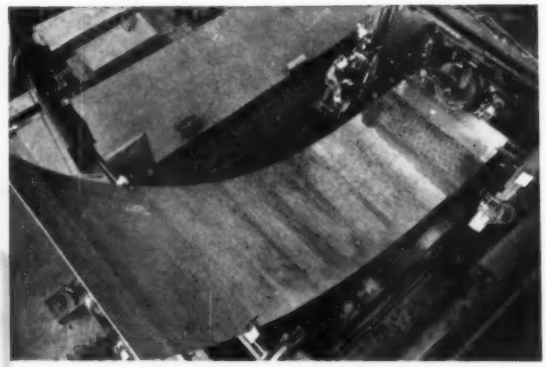
A. O. Smith was able to accomplish this desired end because, a few years prior to 1925, the Company's scientists and engineers had created welds that possessed ductility. It has long been possible to make steels with almost any degree of ductility desired, but this was not true of welds. So when A. O. Smith was able to join ductile steels with welds of comparable ductility, the petroleum refiner was freed from the earlier limitations of cost, productive capacity and design.

TODAY'S HUGE VESSELS are much more complicated than those of a quarter-century ago. This one was so large that A. O. Smith designed and built a special portable furnace in order to stress-relieve the welds.

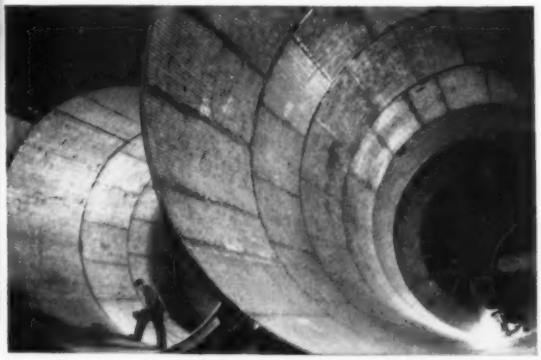


...FURTHER IMPORTANT

A. O. Smith Has Provided Unique Solutions to Problems of



ALLOY LINING to protect pressure vessels from corrosion was a development of A. O. Smith. The Company designed special equipment (shown above) that automatically applies hundreds of spot welds an hour. The interiors of partly finished lined vessels are shown below.



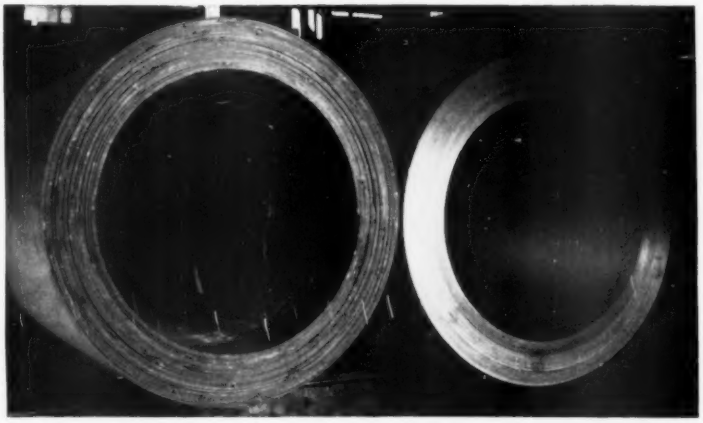
Since 1925, A. O. Smith has built more than a quarter million tons of all-welded pressure vessels, a large percentage of which have gone into service in the oil refineries of the world.

A. O. Smith's progress in this field has been due to extensive and consistent research in the twin fields of metallurgy and welding, coupled with intensive engineering studies of design and stress problems. The Company has stayed constantly abreast of process developments in the petroleum industry it serves, has worked closely with the technicians of the steel industry, and is continuously at work developing new welding techniques for vessel fabrication.

Partly as a result of A. O. Smith's entry into this field, the technology of the petroleum industry developed so rapidly that by the early 1930's demands for extra high pressures produced new problems of weight and safety. The solution of these problems called for some radical departures from orthodox design principles.

A. O. Smith's answer was to develop a unique type of vessel construction now known as "multi-layer." A relatively thin plate of steel is rolled into a cylinder and seam welded. Then another layer is wrapped around the cylinder and welded. Successive layers can be added almost indefinitely until the vessel wall has been built up to any desired strength. Here is a vessel that answers special problems of safety and top strength at minimum weight and relatively low cost.

As higher temperatures and greater pressures tremendously accelerated corrosion, A.O.Smith developed the knowledge and skill



MULTI-LAYER construction of pressure vessels was another step in which the Company brought to the oil industry greater safety and lower costs. Multi-layer vessels can be made in any diameter for which satisfactory end closures are available. Walls can be made stronger merely by increasing the strength of the steel or by adding more layers. There are no practical limits to the length of these vessels, since shell sections can be welded together in the field as well as in the shop.

VESSEL CONTRIBUTIONS

77th ANNIVERSARY 1874 · 1951

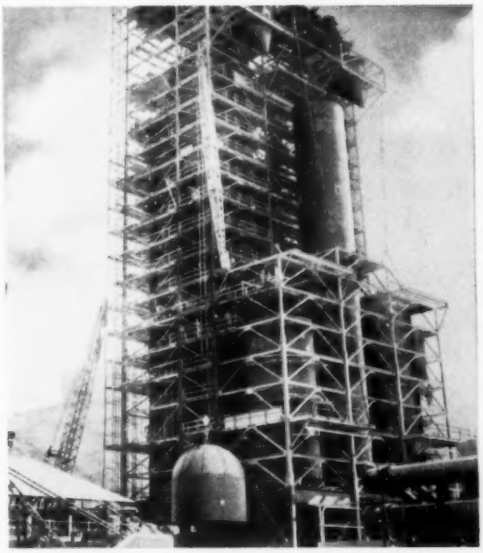
Design, Material Selection and Methods of Fabrication

to "line" vessels with comparatively thin layers of a wide variety of alloy steels and other non-corrosive metals. Special techniques, fixtures and machines had to be found. The liners were spot welded to the inside of the vessel with thousands of welds. This work had to be done efficiently or costs would soar. Special machines were designed and built that could apply hundreds of spot welds an hour.

Huge furnaces were erected so that the stresses created by welding could be relieved. Some of the heaviest bending rolls in the country were installed in the A. O. Smith vessel shops so that thick plates of steel could be shaped to exact contours. Hydrostatic testing equipment and big X-ray machines were provided so that vessels could be tested and even the minutest welding flaws detected.

As new processes called for vessels that exceeded railroad shipping limitations, it became necessary to fabricate them in sections in the shops and then assemble them in the field. This development raised whole new sets of problems of field assembly, welding and stress-relieving, problems that were solved through A. O. Smith's unique combination of research engineers and facilities.

In the more than two decades that A. O. Smith has been studying these problems, it has amassed a tremendous fund of knowledge and skill that today is continuing to serve the expanding oil industry.



FIELD ASSEMBLY of vessels too large to ship is done under carefully controlled conditions of welding and stress-relieving.

EXPANDED HEAT EXCHANGER FACILITIES

At its Milwaukee Works, A. O. Smith recently installed greatly expanded facilities for the manufacture of the many types of heat exchangers required in the refining industry.

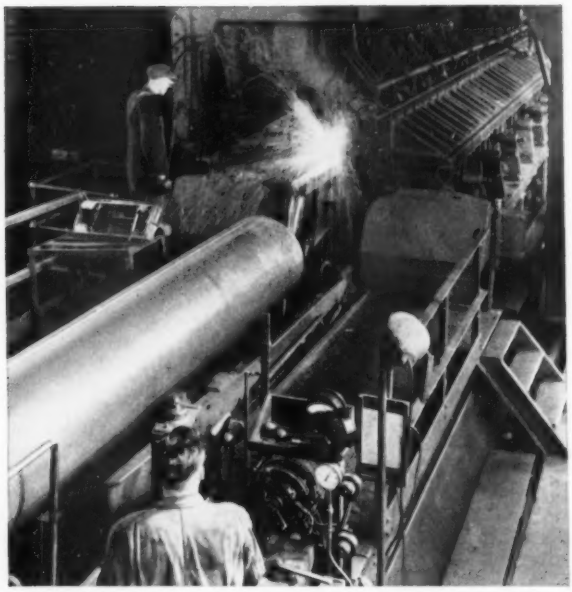
Concentrated within the Company's modern plant is everything it takes to solve the most complex problems of heat exchanger design and construction.

Specialists in heat exchanger engineering and metallurgy—supervisors and mechanics with the know-how that comes from long experience—plus skill in both welding and fabrication—these are the tools with which A. O. Smith solves the most exacting heat exchanger problems.

WELDED LINE PIPE

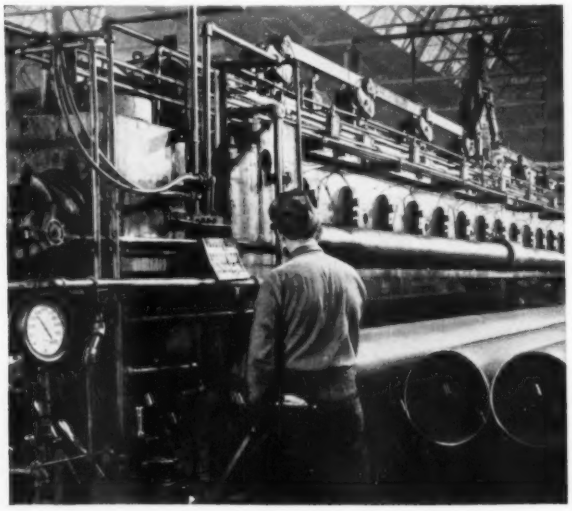
77th ANNIVERSARY 1874 · 1951

Improved Techniques Increased Strength and Lowered Cost



FLASH WELDING of large diameter steel pipe is done in spectacular fashion in the A. O. Smith mills. Lengths of 40 feet are welded in 30 seconds.

INTERNAL SIZING of the pipe greatly increases the yield strength of the steel. This is translated into lighter walls and lower costs.



Two of the important contributions that A. O. Smith made to the oil industry were the introduction of flash welding to line pipe fabrication and the development of an internal sizing process which substantially increased the yield strength of the pipe without increasing the cost.

The Company first produced such pipe in the late 1920's. The longitudinal weld was actually stronger than the rest of the pipe. This method of fabrication resulted in lighter and stronger pipe that could be produced faster and at lower cost.

Oil men saw this new kind of pipe subjected to almost every conceivable test, saw it twisted like a licorice stick, wrinkled like an accordion, and crushed flat to prove the weld was amazingly ductile and would not break. When the test pipe was subjected to such terrific internal pressure that it burst, the rupture was not at the weld, but in the parent metal itself.

Prior to 1927, the total producing capacity for larger diameter pipe in the United States was about three miles per day. But here was a single company that could weld each 40-foot pipe in 30 seconds, turning out thousands every day.

What did this mean? It meant that hundreds of miles of pipeline could be built in a matter of weeks instead of years. The welded pipe meant thinner and lighter welds and a tremendous saving of steel per mile with no sacrifice of strength. This meant lower shipping costs and greater ease of handling the pipe in the field.

Virtually overnight, many contemplated pipeline projects became financially and engineeringly practical. The oil industry began to envision a great system of interlacing pipelines that would encompass the nation in its web.

This didn't come all at once. It was years before thousand-mile lines were common. Not until the thunderous days of World War II was it conclusively proved that oil could be moved across the country cheaper in pipelines than by any other method. It took decades of toil and billions of dollars of financing before the great reservoirs of natural gas were available to all parts of the nation. But today this system of pipelines equals in length all the main line rail trackage in the United States. A. O. Smith opened the door to what has become one of the great economic assets of America.

A. O. Smith pipe, part of every major pipeline in the nation, comes from the world's largest plants producing large diameter welded pipe and oil well casing.

TRAINLOADS OF PIPE move out of A. O. Smith every day to supply the never ending demand for faster and more efficient transportation of petroleum products. SMITHway electric-welded pipe appears—in part or in whole—in every major line in the country.

WELDING

A. O. Smith Developed Field Welding of Pipe to Eliminate Leakage

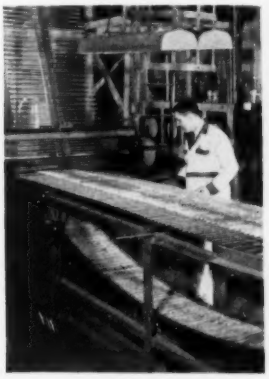
One of the early problems that faced the line pipe industry was how to join the lengths of pipe so they would form a tough, strong line, and how to overcome the problem of leakage.

Some of the early lines were held together with couplings. The couplings were expensive to make; they had to be threaded carefully; and each end of each length of pipe also had to be threaded; and even the most perfect coupled joints allowed some leakage. Total leakage over a thousand miles of coupled line constituted a severe economic strain. Various other methods had such shortcomings as high manufacturing costs or inefficiency in joining the pipe in the field.

A. O. Smith research developed special welding electrodes and welding machines that could be used in the field. The ends of the lengths of pipe were beveled so that when two pieces were held together by a jig, the welder could first "tack" and then, by removal of the jig, complete his weld. This produced continuous, substantially stronger joints and eliminated leaks. SMITHwelded joints have already saved millions of dollars and vast tonnages of steel.

TOUGH WELDS join thousands of miles of pipeline across the country. A.O. Smith's development of pipe welding in the field eliminated leakage.

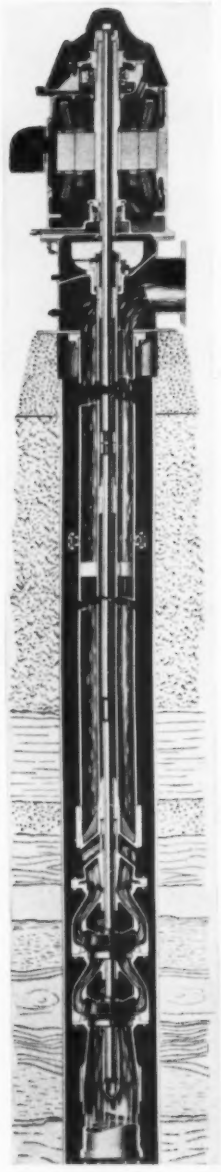
AC WELDING MACHINES of marked superiority were developed and manufactured by A. O. Smith and today serve many industries.



COATED ARC WELDING ELECTRODES for high ductility, first developed by the A. O. Smith Corporation, now come off its lines by the millions.

METERS, MOTORS, PUMPS

These A. O. Smith Products Measure the Flow of Petroleum Products, Provide Electrical Energy and Supply Water to the Oil Industry

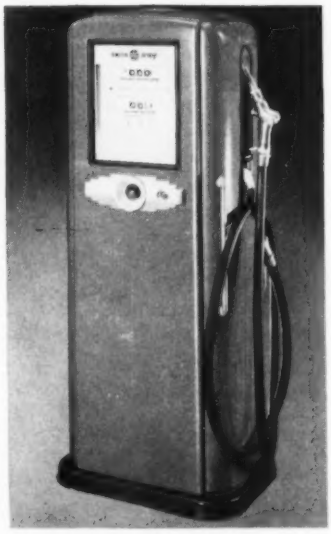


VERTICAL TURBINE PUMPS range in size from 4-inch to 20-inch and can deliver up to 5,000 gallons of water per minute. Many of them are serving the oil industry.

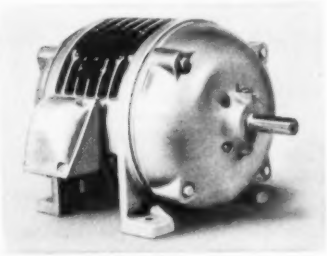
In its plant in Los Angeles, A. O. Smith is producing a wide variety of meters that regulate and measure the flow of petroleum liquids. The Company makes vertical turbine pumps that are used to furnish the great quantities of water needed in the oil industry. A. O. Smith also manufactures gasoline filling station pumps and the motors that activate them. In its plant in Tipp City, Ohio, the Company produces explosion-proof motors used for a variety of purposes in the oil industry.

Standard electric motors, and many special motors, range in single phase from a quarter horsepower to 15 horsepower, and in polyphase up to 150 horsepower.

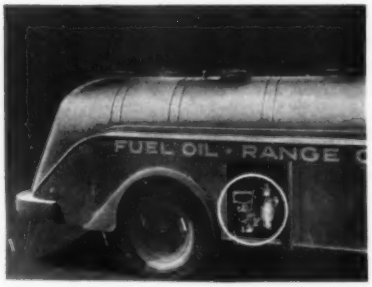
The Company produces a complete line of vertical turbine pumps, and is the only company that makes all of the component parts of the pump. They are of two types, oil lubricated and water lubricated. The pumps are built both with closed impellers and semi-open impellers. They range in size from 4-inch to 20-inch, and deliver from 35 to 5,000 gallons per minute.

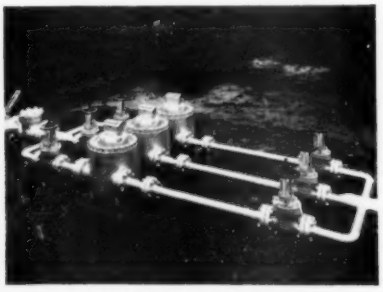


GASOLINE PUMPS made by A. O. Smith appear in filling stations throughout the land. These pumps are equipped with A. O. Smith motors.

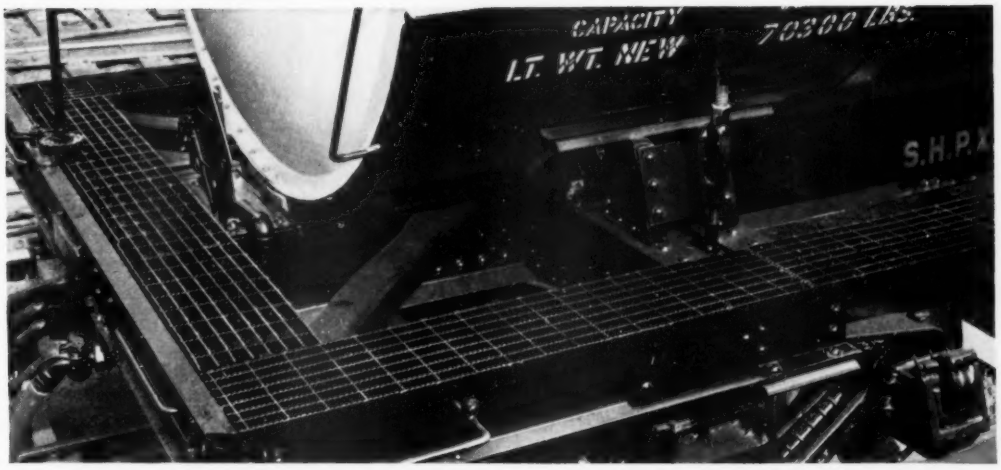


SAFE MOTORS that are explosion-proof are made by the A. O. Smith Corporation expressly for use in the oil industry.





METERS that measure the flow of petroleum products are made by A. O. Smith for crude oil measurement, refineries, pipelines, loading racks and tank trucks. A high speed meter for trucks is shown at left. The other picture shows a high-pressure meter on a pipeline.



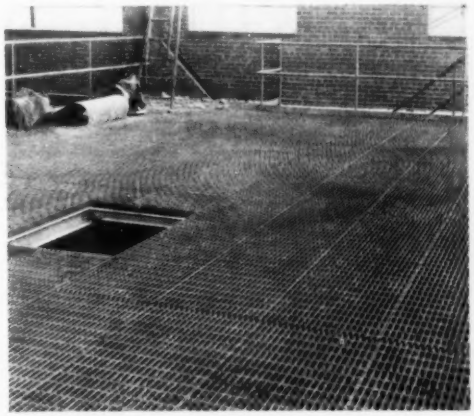
RAILROAD GRATING is manufactured by A. O. Smith and is standard equipment on tank cars moving petroleum products.

SAFETY GRATING

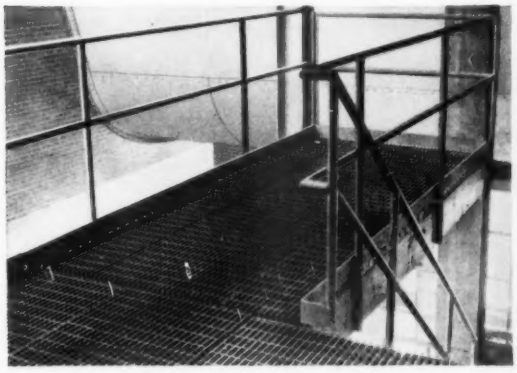
Provides Sure Footing for the Oil Industry — on Tank Cars and in Refineries

A. O. Smith patented steel grating appears in steps, floors and walkways for refineries, oil tank cars and wherever else sure footing is required.

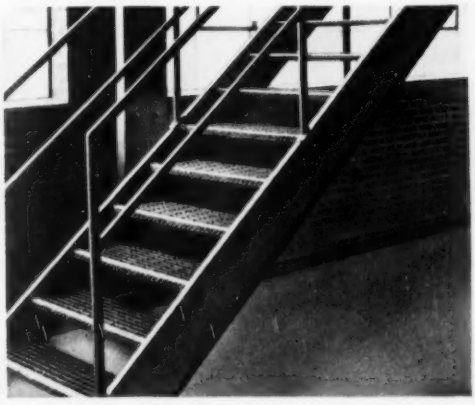
This lightweight grating provides a maximum of light and air, where these factors are important, and is produced at minimum cost. Mechanical locking of the grating assures absence of repair and misalignment problems and simplifies painting and upkeep. The serrated safety tread, on both bearing bars and cross bars, provides non-slip protection under all conditions. The absence of acute angles between bearing and cross bars eliminates dirt pockets so that the grating is self cleaning.



FLOOR GRATING that is strong and economical provides safety, cleanliness and easy maintenance around the refinery.



SAFE CATWALKS bearing the SMITHway trade-mark are fabricated in a complete range of sizes for the oil industry.



STAIRWAYS made of A. O. Smith grating provide sure footing, easy cleaning, and a maximum of light and air.

CARLOADS OF liquefied petroleum gas system tanks move out of the Houston Works to all parts of the United States.

LPG SYSTEMS provide rural and suburban homes with gas for cooking, water heating, house heating and power.

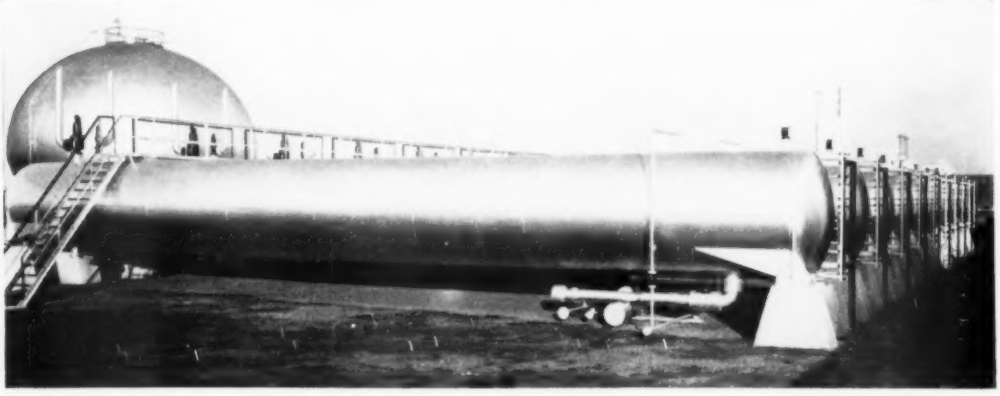
LIQUEFIED PETROLEUM GAS TANKS

A. O. Smith Makes Them for a Wide Variety of Applications

At the end of World War II, A. O. Smith began the production of liquefied petroleum gas systems at its plant in Houston, Texas. The system consists essentially of a pressure vessel in which gas is stored in liquid form under pressure. Equipped with proper controls and piping, the vessels provide gas for use in suburban and farm homes, as well as industrial uses and bulk storage.

Since 1945 A. O. Smith has produced nearly 100,000 such systems, ranging in capacity from 250 gallons to 30,000 gallons, and is the largest manufacturer of them in the nation. The systems are used to cook food, heat water, heat homes, provide power, and supply vast amounts of LPG for industrial furnaces and other manufacturing needs. These same systems are now finding new applications in powering taxicabs, buses and tractors. Here is a typical example of how the oil industry has moved steadily forward, this time finding commercial use for butane and propane gases that previously had been wasted.

INDUSTRIAL USES are manifold for LPG. Large volume tanks such as shown here provide billions of B.T.U.'s for industrial purposes every day.



BULK STORAGE tanks are available in any size and capacity. A typical battery of SMITHway tanks stores liquefied petroleum gas at an installation in Texas. These tanks are manufactured in the A. O. Smith Corporation plant at Houston, Texas.

GAS HEATING UNITS

77th ANNIVERSARY 1870 · 1951

A. O. Smith Water Heaters, Gas Conversion Burners, House Heating Boilers Burn Natural, Manufactured, Mixed and LP Gases

Since the mid-1930's, billions of cubic feet of gas have been consumed in A. O. Smith heating units. These units encompass domestic automatic water heaters, commercial water heaters, house heating boilers and gas conversion burners.

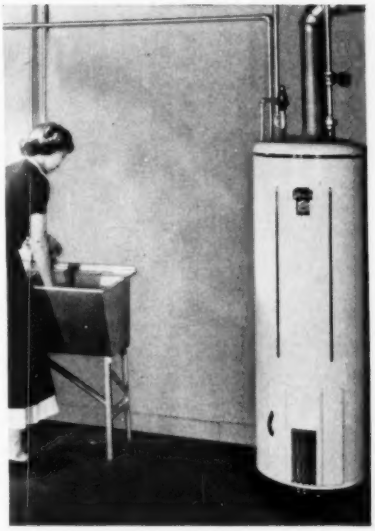
The Company's entry into these fields came about because of A. O. Smith's technique of fusing glass to steel. The Company applied it to the inner wall of the tank of a domestic water heater to meet the problem of corrosion, a serious one in the water heater field. The result was the now-popular *Permaglas* water heater, a unit that has been described as offering "hot water packaged in glass and heated with gas."

Later, in order to offer a complete line of heaters that would serve all levels of consumers, A. O. Smith produced lower priced heaters in which a heavy coating of zinc replaced the glass inner surface. Since the end of World War II, the Company has produced hundreds of thousands of gas water heaters and they are being sold throughout the United States today by more than 6,000 dealers.

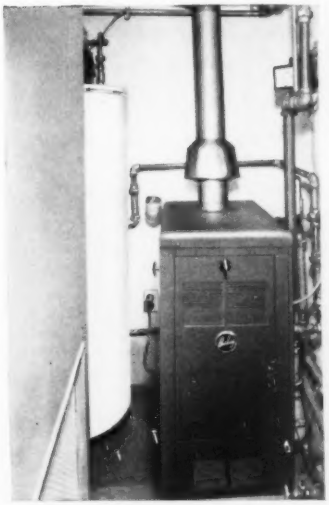
A. O. Smith's next consumer device was a commercial water heater with several interesting features. Because it can provide two temperatures of hot water at the same time, it is widely used in restaurants where hot water is needed for general purposes and superheated water for sanitizing dishes and tableware.

With minor modifications the heater becomes a hot water boiler for heating buildings. A single unit can heat a home of up to 12 rooms, while as many as 120 units have been combined to heat a factory more than a quarter of a mile long.

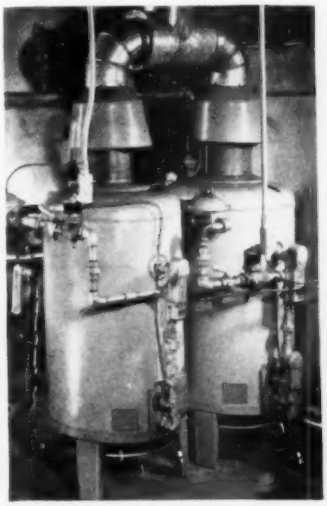
The unique burner of this heater also forms the basis of a line of gas conversion burners which convert coal-burning furnaces into gas furnaces.



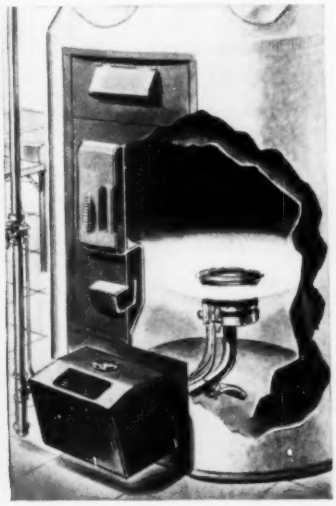
AUTOMATIC WATER HEATERS are produced by the hundreds of thousands every year in the A. O. Smith Works at Kankakee, Illinois.



GAS-FIRED BOILERS provide efficient and compact house heating.



VOLUME WATER HEATERS serve restaurants, hotels, laundries, etc.



GAS CONVERSION BURNERS convert coal burning furnaces to natural gas.

THIS RESEARCH AND ENGINEERING BUILDING houses A. O. Smith's modern laboratories. Here vital chapters have been written in the history of many industries and priceless knowledge has been accumulated. Daily this knowledge serves the Oil Industry.

RESEARCH AND ENGINEERING AT A. O. SMITH

Every advancement that SMITH-way Products have brought to the Oil Industry has come through a continuous program of research

An observer once remarked that the chief "products" of the A. O. Smith Corporation were research and engineering; that line pipe, casing, pressure vessels, welding electrodes and the rest of its output were only by-products.

The remark was facetious of course, but it is true that research and engineering have been basic in the operation of the Company since its early days. A. O. Smith's research and engineering facilities today represent a reservoir of knowledge and skill that is of incalculable value to the many divisions of the oil industry.

The Research and Engineering group has been established as one of the major divisions of the Company. Its work is integrated with policies and plans of the Company that reach decades into the future. Every precaution has been taken to insure that its progress shall go forward without interruption.

It was research and engineering that permitted A. O. Smith to develop welds that were ductile. It was these ductile welds that A.O.Smith used successfully to produce lower-cost casing couplings, larger and better pressure vessels, and stronger and lighter line pipe. It was A. O. Smith's knowledge of metallurgy that resulted in alloy linings for pressure vessels and the ability to spot weld the linings so that they would not fail. Multi-layer construction, that made stronger and safer vessels at lower cost, came directly out of A. O. Smith's research.

Today the central Research and Engineering Division carries on an organized and co-ordinated program in

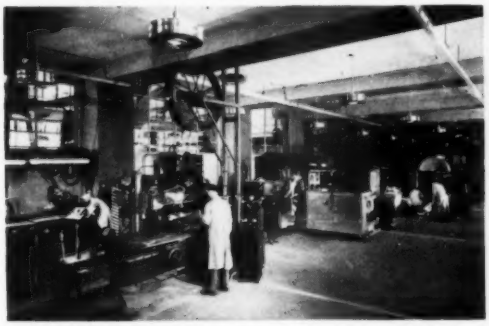
such fields as spectrography, X-ray diffraction, metallurgy, welding, materials testing, mechanical testing, chemistry, physics, hydraulics, electronics and ceramics. All of these resources are available in the service of the Company's customers.

The Company's interest in research and engineering goes beyond its own walls. Practical manpower limitations preclude the investigation of many fields of basic research that can contribute to the constantly growing fund of knowledge. The Company has arrangements with outside consultants to carry on some of this basic work. Among them are the Massachusetts Institute of Technology, the California Institute of Technology, the University of Illinois, Purdue University, the University of Wisconsin and others. Individual consultants have been retained in the gas, oil and other industries.

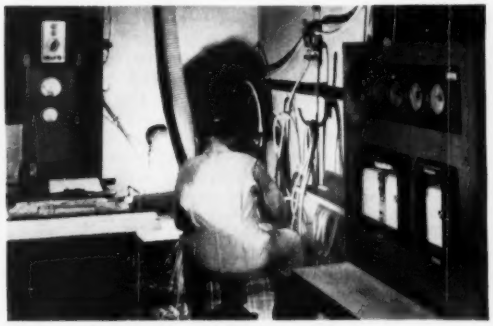
To bear full fruit, all of this work must be on a sustained basis that will be secure against the vagaries of the business cycle. A continuous acquisition of knowledge and understanding is not a luxury, to be enjoyed only in prosperous years. It is a vital and continuing need, more essential in so-called bad times than in good. So the Company sets aside money annually, measured in millions of dollars, to carry on the activities of research and engineering. These reserves are a measure of the importance that A. O. Smith attaches to study and experimentation. They are a measure of the service that A. O. Smith can and does render to the oil industry.

HEAT TREATING is an important part of metallurgical research in the pressure vessel field.

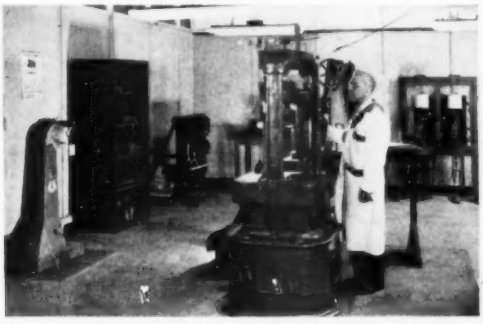
METALLOGRAPHIC EXAMINATION reveals the condition of vessel steels and weld materials.



WELDING LABORATORY—Center of research covering electrodes, procedures, processes and equipment.



WELDING PROCEDURE CONTROL insures successful welding in the shop and field.



PHYSICAL TESTING laboratory studies tensile strength, fatigue, impact and torsion of steels.

SPECTROSCOPY is used to examine steel, alloys, electrode core wire, and electrode coating materials.

MILWAUKEE WORKS—Automobile frames, control arms, tubular goods, railroad products, pressure vessels, heat exchangers, safety grating, welding electrodes and equipment.

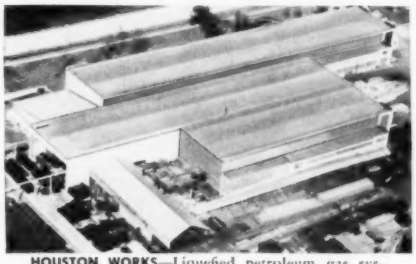
PLANT LOCATIONS

From its small beginning 77 years ago in Milwaukee, Wisconsin, the A. O. Smith Corporation today is a complex organization with plants that are spread across the nation. Strategically located from the standpoint of raw materials and markets, these plants are pouring out a variety of capital and consumer goods most of which are contributing to the advancement of the oil industry.

The Milwaukee Works produces line pipe, oil well casing, pressure vessels, safety grating and welding electrodes and equipment. The Houston Plant turns out pressure vessels, liquefied petroleum gas systems and vertical turbine pumps. A. O. Smith's Pacific Coast Works at Los Angeles makes meters, motors and pressure vessels. At Kankakee, Ill., the Company turns out more than 1,500 domestic water heaters a day. From Toledo come volume gas water heaters, gas house heating units and gas conversion burners. Electric motors are made at Tipp City, Ohio, and gasoline filling station pumps are produced in Succasunna, New Jersey.

PACIFIC COAST WORKS—Motors, meters, pressure vessels, and vertical turbine pumps.

KANKAKEE WORKS—Automatic water heaters that burn natural, manufactured, mixed and LP gases.



HOUSTON WORKS—Liquefied petroleum gas systems, vertical turbine pumps, pressure vessels.

TOLEDO, OHIO—Volume water heaters, house heating boilers and gas conversion burners.

TIPP CITY, OHIO—Electric motors.

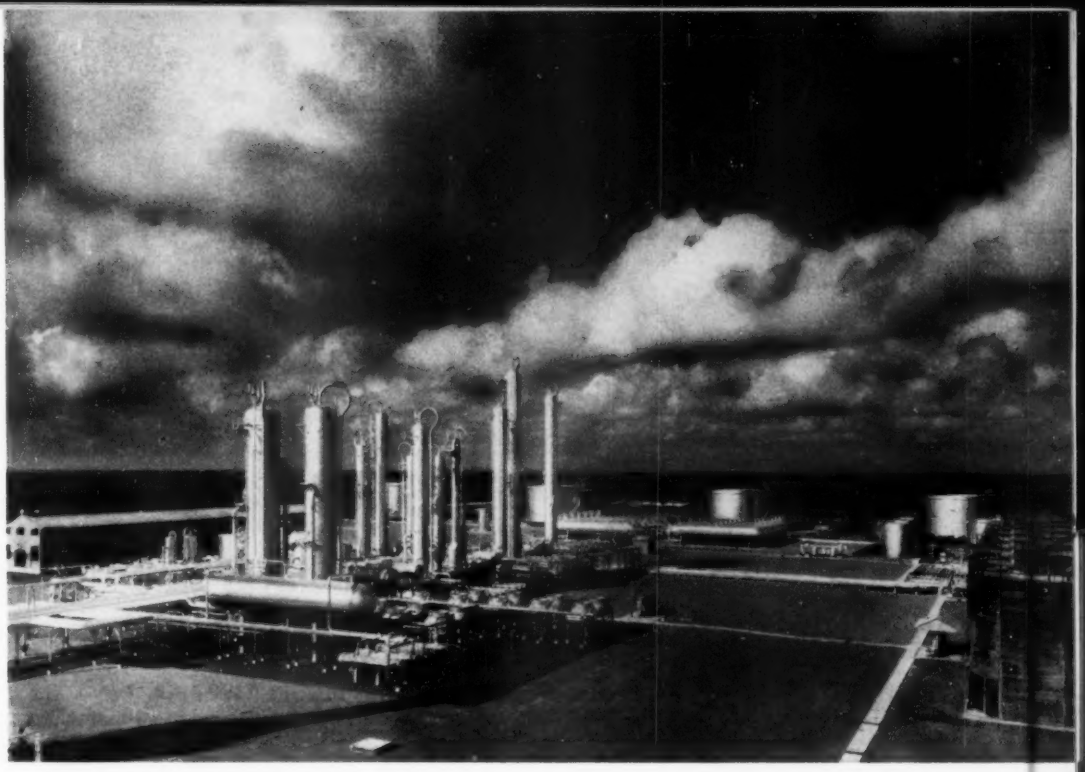
SUCCASUNNA, N.J.—Gasoline dispensing pumps.

A.O. Smith 1874 1951 77th Anniversary

A.O.Smith
CORPORATION

Factories at: Milwaukee • Kankakee, Ill. • Houston Los Angeles • Toledo • Tipp City, O. • Succasunna, N.J. International Division: Milwaukee 1

Boston • Chicago • Cleveland • Dallas • Denver Detroit • Houston • Los Angeles • Midland, Tex. Milwaukee • New Orleans • New York • Philadelphia • Phoenix • Pittsburgh • San Francisco Seattle • Tulsa • Washington, D.C.



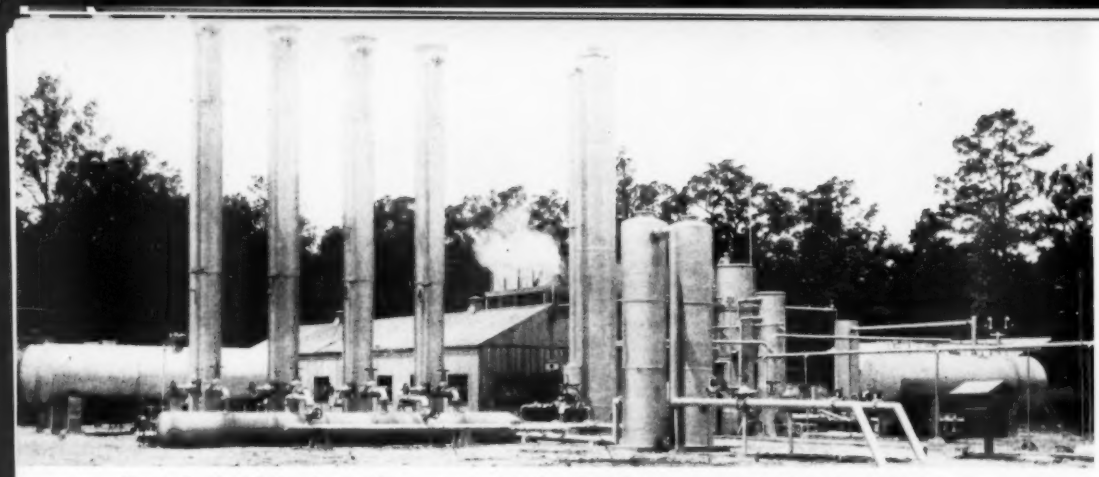
Natural Gasoline

NATURAL-GASOLINE MANUFACTURE AND RELATED OPERATIONS INCLUDE:

- Gas Gathering
- Gas Dehydration
- Gas Desulfurization
- Gas Compression
- Compression-Absorption Plants
- Liquefied Petroleum Gas Manufacture
- Special-Products Plants
- Crude and Distillate Stabilization
- Motor-Fuel Production
- Gas Repressuring
- Pressure Maintenance
- Cycling
- Gas-Lift Service

THE natural-gasoline branch of the oil and gas industry consists of a multiprocessing and multiproduct operation. As listed on this page the manufacture of natural gasoline and related products is tied in directly with many crude-oil and natural-gas production operations, including those which are basic in the application of conservation regulations. Gradually through the years natural-gasoline practices have become an integral part of large and small field operations looking to the greatest recovery of oil and gas with a minimum of economic and physical waste.

As to growth, the Southwest's 366 natural-gasoline and 48 cycling plants in January this year were producing 435,000 bbl. daily of liquefied petroleum. This was equal to the Southwest's crude-oil output as late as 1916. Reflecting the diversified operations the January output based on national averages was 45 per cent liquefied petroleum gases, 38.5 per cent natural gasoline, 10 per cent finished motor fuel and naphthas, 4.3 per cent condensate, and 1.8 per cent other products.



Plant of Standard Carbon Co. near Monroe, La., built in 1923. Four Tulsa-type (now Flint Steel Corp.) absorbers were among the first of "packed column" design used by natural-gasoline industry.

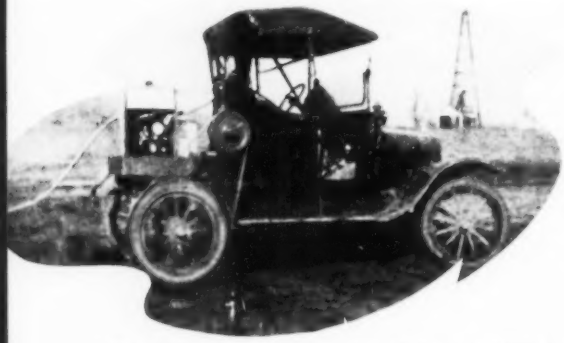
Phenomenal Growth Marks Natural-Gasoline

by C. O. Willson

IN early 1909 D. W. Franchot and associates started operating what was then known as a "casing-head gasoline" plant at Kiefer, Okla., with "wet" gas obtained from a few wells in Glenn pool.

The initial production of this plant, consisting of compressors of small capacity and improvised cooling and auxiliary equipment, totaled a few hundred gallons weekly.

This was the start in the Southwest of what is now a major division of petroleum operations. The southwestern states today account for 70 per cent of the 532 natural-gasoline and cycling plants and 78 per cent of the production, which for January 1951, totaled 558,000 bbl. daily.



First test car built by Chestnut & Smith Corp., of Tulsa, for many years one of the largest natural-gasoline manufacturers.

The Franchot plant had been preceded by the installation of a number of small plants in fields east of the Mississippi River. Eastern operators by 1904 had made commercial applications of the discovery that by applying pressure and then cooling the gas obtained from oil wells, products were obtainable which had many of the characteristics of refinery gasoline.

The early operators were unable to account for the wide variations in the recovery of gasoline from the wet gas of the oil wells and the "lean" gas from wells which did not produce a liquid product. This resulted in research work, principally by the Bureau of Mines, which gave the industry new information on the chemical and physical properties of lighter hydrocarbons found in natural gasoline and refinery gasoline.

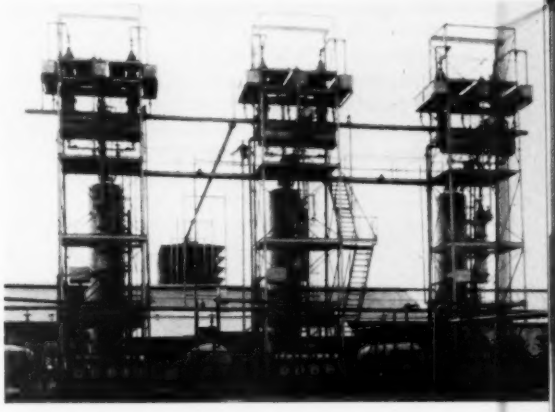
It is interesting to note that, writing in 1911 on the "Production of Gasoline from Natural Gas," Frank Peterson, now retired in Tulsa, presented many of the basic data around which the modern natural-gasoline operations evolved, including the adoption of specifications for the finished products.

Peterson, shortly after preparing the booklet for Bessemer Gas Engine Co., Grove City, Pa., left for the Southwest where he was prominently identified with natural-gasoline-plant construction and operation for many years.

In his booklet Peterson presented the following analysis of the composition of natural gasoline and refinery gasoline:

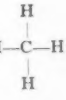
The No. 13 plant of Sinclair Oil & Gas Co., located in Seminole, Oklahoma, field. When built in the late twenties it was the largest single plant of the natural-gasoline industry.

Expansion in Southwest

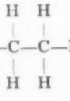


First installation of towers designed to recover propane and butane as liquid products for distribution as liquefied petroleum gases in 1926. The towers were located at the Burbank field, Oklahoma, plant of Phillips Petroleum Co.

CH_4 Methane, represented thus



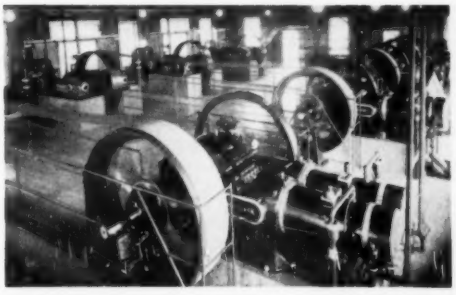
C_2H_6 Ethane, represented thus



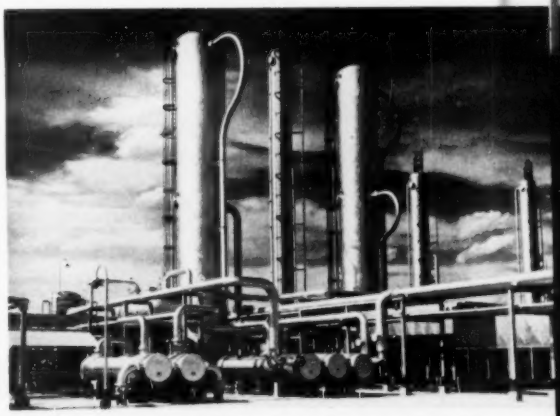
and C_3H_8 Propane:
C_4H_{10} Butane:
C_5H_{12} Pentane:
C_6H_{14} Hexane:
C_7H_{16} Heptane:
C_8H_{18} Octane:

} Natural gas gasoline
} Refinery gasoline.
} The graphic grouping in some sense representing the character of the two products as found in the market.

Later the natural-gasoline manufacturers found it expedient to remove the propane from



Engines in compressor room in Magnolia Petroleum Co. plant at Cushing, Okla., in 1916. (Bessemer units).



This North Cowden, Tex., major plant operated by Stanolind Oil & Gas Co. is typical of several postwar installations. It represents a cooperative operation for a group of 21 owners.

There have always been economic hazards in operating natural-gasoline plants. The above plant was built by Phillips Petroleum Co. near Pershing in Osage County, Oklahoma, in 1920. It was dismantled in 1937 because of a lack of adequate gas supplies.

their product and also to reduce the butane content in order to meet the requirements of blenders.

Oklahoma producers were quick to realize the possibilities of the new operation. In Glenn pool by 1911 there were seven plants with an output of 2,000 gal. daily.

Fortunately, starting with the Glenn pool development and for 20 years thereafter, prices for natural gasoline and the blended products were favorable. A 1913 report shows that whereas crude oil at the well brought only 88 cents per barrel in Oklahoma, natural gasoline could find a ready market at 10 to 12 cents per gallon.

Compared to today's plants, where investments range from several hundred thousand dollars to several million dollars, the early expenditures were modest. One writer in 1916 explained the cost of compression and condensing equipment for a plant which would handle 120,000 cu. ft. of casing-head gas daily was $2,800. This included a 15-hp. gas engine and a low-stage compressor (50 lb.) and a second 15-hp. engine to operate a 250-lb. compressor. The other equipment necessary for operation, including water-cooling facilities and a 5-hp. electric-light unit, was extra.

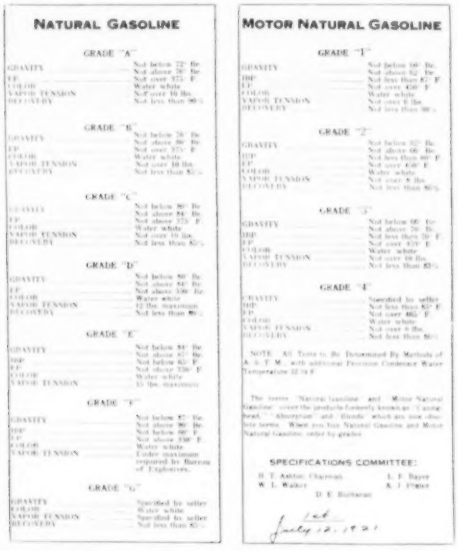
Blended With Naphtha Cuts

Most of the product was blended with naphtha cuts obtained in refining crude oil. The manufacturers either sold their product to the refiners who did the blending or they bought the naphtha from the refiners and did their own blending. Independent jobbers soon learned to buy the naphtha and natural gasoline for blending purposes.

Motor fuel previous to 1918 was largely sold on a Baumé (now A.P.I.) gravity basis. Premiums were paid for the higher-gravity refinery motor fuels which gave satisfactory service during the 1905-1920 period when carburetors and engines were designed for their use.

By blending the high-gravity natural gasolines—85° to 95° A.P.I.—with refinery naphthas of 50° to 56° gravity, a high-gravity fuel was obtained. Unless the blends contained a large percentage of the most volatile fractions of natural gasoline they gave satisfactory service in the engines of that period.

The Glenn pool gasoline plants increased in



NATURAL GASOLINE

GRADE "A"

GRAVITY	Not below 72° Be.
	Not above 76° Be.
IBP	Not over 372° F.
EP	Not over 410° F.
COLOR	Water white.
VAPOR TENSION	Not over 10 lbs.
RECOVERY	Not less than 90%.

GRADE "B"

GRAVITY	Not below 76° Be.
	Not above 80° Be.
IBP	Not over 372° F.
EP	Not over 410° F.
COLOR	Water white.
VAPOR TENSION	Not over 10 lbs.
RECOVERY	Not less than 92%.

GRADE "C"

GRAVITY	Not below 80° Be.
	Not above 84° Be.
EP	Not above 375° F.
COLOR	Water white.
VAPOR TENSION	Not over 10 lbs.
RECOVERY	Not less than 92%.

GRADE "D"

GRAVITY	Not below 80° Be.
	Not above 84° Be.
EP	Not above 390° Be.
COLOR	Water white.
VAPOR TENSION	12 lbs. maximum.
RECOVERY	Not less than 90%.

GRADE "E"

GRAVITY	Not below 84° Be.
	Not above 87° Be.
IBP	Not below 82° F.
EP	Not above 320° F.
COLOR	Water white.
VAPOR TENSION	12 lbs. maximum.

GRADE "F"

GRAVITY	Not below 87° Be.
	Not above 90° Be.
IBP	Not below 90° F.
EP	Not above 330° F.
COLOR	Water white.
VAPOR TENSION	Under maximum required by Bureau of Explosives.

GRADE "G"

GRAVITY	Specified by seller
COLOR	Water white.
VAPOR TENSION	Specified by seller
RECOVERY	Not less than 85%.

MOTOR NATURAL GASOLINE

GRADE "1"

GRAVITY	Not below 90° Be.
	Not above 92° Be.
IBP	Not less than 85° F.
EP	Not over 420° F.
COLOR	Water white.
VAPOR TENSION	Not over 8 lbs.
RECOVERY	Not less than 90%.

GRADE "2"

GRAVITY	Not below 85° Be.
	Not above 90° Be.
IBP	Not less than 80° F.
EP	Not over 430° F.
COLOR	Water white.
VAPOR TENSION	Not over 8 lbs.
RECOVERY	Not less than 90%.

GRADE "3"

GRAVITY	Not below 80° Be.
	Not above 85° Be.
IBP	Not less than 70° F.
EP	Not over 430° F.
COLOR	Water white.
VAPOR TENSION	Not over 10 lbs.
RECOVERY	Not less than 85%.

GRADE "4"

GRAVITY	Specified by seller
IBP	Not less than 82° F.
EP	Not over 465° F.
COLOR	Water white.
VAPOR TENSION	Not over 8 lbs.
RECOVERY	Not less than 86%.

NOTE—All Tests to Be Determined By Methods of A. S. T. M., with additional Provision Condenser Water Temperature 32-34° F.

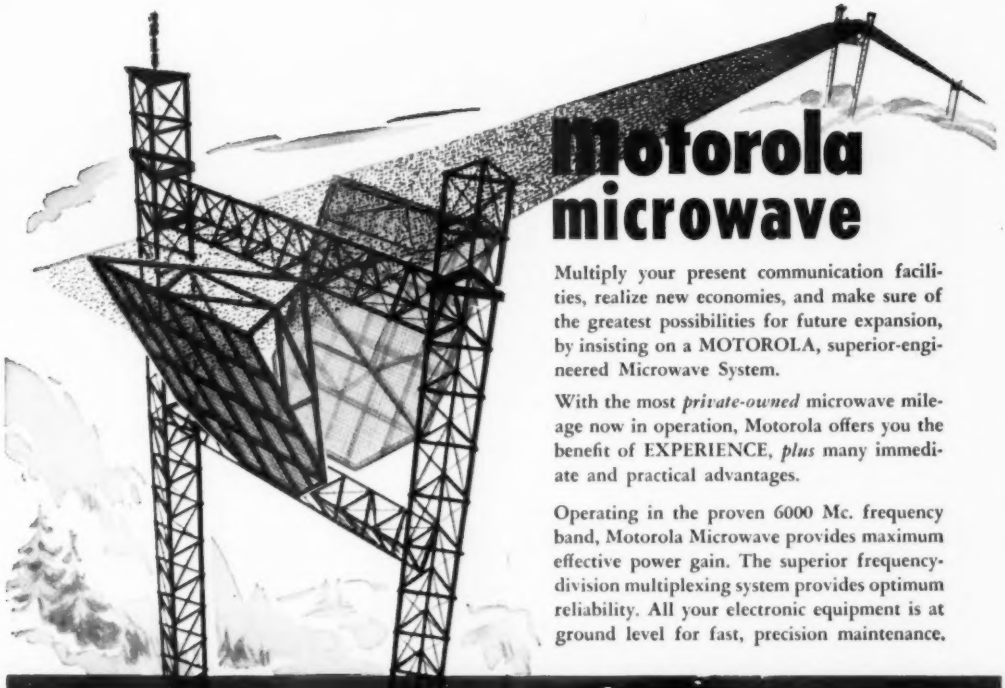
The terms "Natural Gasoline" and "Motor Natural Gasoline" cover the products formerly known as "casinghead," "Absorption" and "Blends" which are now obsolete terms. When you buy Natural Gasoline and Motor Natural Gasoline, order by grades.

SPECIFICATIONS COMMITTEE:

H. T. Anstutz, Chairman — L. F. Bayer
W. L. Walker — A. J. Peiler
D. E. Richeson

July 12, 1921

One of the first projects of the Association of Natural Gasoline Manufacturers after being organized in 1921 was to agree on specifications covering several grades of natural gasoline and blended gasoline, then known as motor natural gasoline. Here are the first specifications as finally approved. Later the motor natural-gasoline grades were dropped and the grades of natural gasoline were revised.

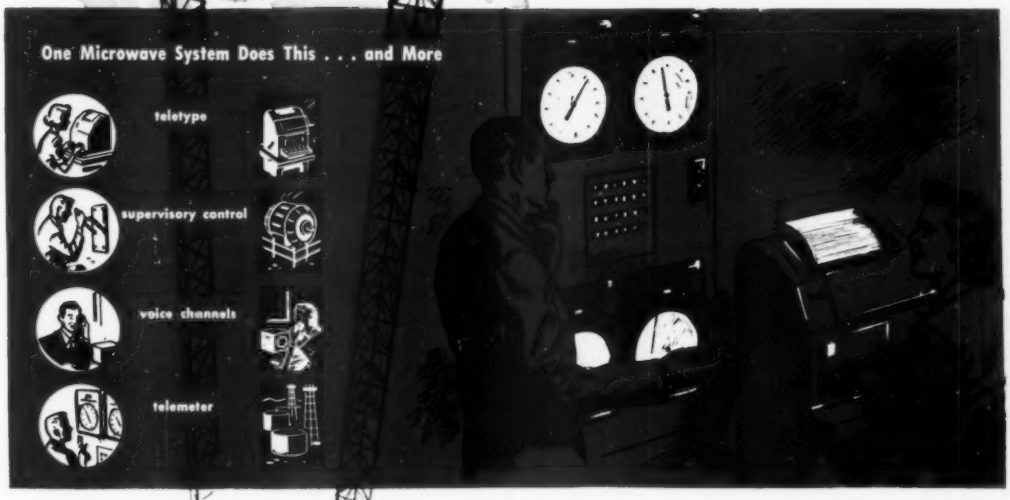


Motorola microwave

Multiply your present communication facilities, realize new economies, and make sure of the greatest possibilities for future expansion, by insisting on a MOTOROLA, superior-engineered Microwave System.

With the most *private-owned* microwave mileage now in operation, Motorola offers you the benefit of EXPERIENCE, *plus* many immediate and practical advantages.

Operating in the proven 6000 Mc. frequency band, Motorola Microwave provides maximum effective power gain. The superior frequency-division multiplexing system provides optimum reliability. All your electronic equipment is at ground level for fast, precision maintenance.



Installations

Aeronautical Radio Incorporated
State of California
Pan American Pipeline Co.
Shell Pipeline
Panhandle Eastern Pipeline Co.
Texas Illinois Natural Gas Pipeline Co.
Mid-Valley Pipeline Co.
Brazos River Electric Transmission Cooperative
City of Dayton, Ohio
Michigan State Police

Motorola Microwave is the super communication "pack horse" of complete round-the-clock reliability. Cross-town or cross-country, office to plant—to branch—to mobile crews, it provides multi-channel facilities for voice circuits, supervisory control networks, telemeter, and teletype, 2-way radio tie-in, with innumerable additional combinations for automatically and simultaneously operating your entire system. Motorola Microwave means efficient, economical point-to-point communication.

Motorola COMMUNICATIONS AND ELECTRONICS DIVISION

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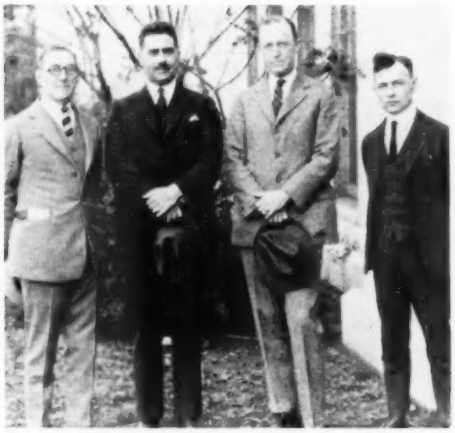
World leaders in FM 2-way radio communications • 2-way mobile • portable • microwave • carrier and control • supervisory control equipment



First officers of the Association of Natural Gasoline Manufacturers elected in 1921: A. V. Bourque, executive secretary; D. E. Buchanan, Chestnut & Smith Corp., vice president; J. H. Welch, Tidal Refining Co., president; and O. W. Crick, Highway Oil & Refining Co. (deceased). Bourque is now associated with Mid-Continent Oil and Gas Association, Tulsa; Buchanan is president of Hiwan Oil & Gas Co., Houston, and Welch is retired in Tulsa.

E. I. Hanlon and J. J. Larkin about to board a plane in the late twenties. The plane was owned by Chestnut & Smith Corp., with which Hanlon was associated. The plane was purchased and operated to demonstrate the performance characteristics of Naturalene, an aviation motor fuel and a natural-gasoline product. Hanlon later organized Hanlon-Buchanan, Inc., which became a large manufacturer and marketer of natural gasoline and related products until its purchase by Warren Petroleum Corp. Hanlon was one of the founders of the natural-gasoline industry in the East and came to the Southwest when it became apparent that this manufacturing phase of the oil and gas industry would rapidly increase in importance. He is now an independent oil producer and chairman of the board of the National Bank of Tulsa. Larkin, who recently passed his eighty-ninth birthday, is the active head of Larkin Torpedo Co., with headquarters in Tulsa. Born in Ohio, he became employed in the oil fields at an early age and was a shooter in the Pennsylvania fields starting 60 years ago.

attractiveness from the standpoint of profits. When the flush-production period was over and the field was on the pump the recovery of natural gasoline from the casing-head gas generally exceeded 5 gal. per thousand cubic feet of gas.

As new fields were discovered in Oklahoma and Kansas, natural-gasoline plants were installed. Cushing field, a major 1912 discovery, by 1914 had a number of plants in operation. Growth was slow in Texas because the early discoveries of the Gulf Coast area, starting with Spindletop, did not supply enough casing-head gas of high gasoline content to justify the installation of recovery plants.

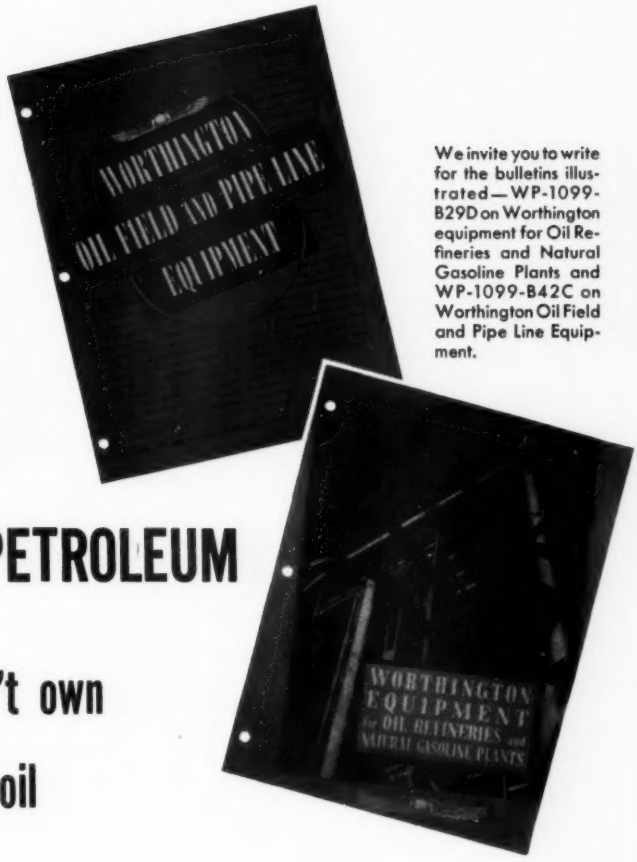
Rapid Expansion

The following table, based on 3-year intervals, taken from a government report reflects the early growth of the natural-gasoline industry in the Southwest:

State—	No. of operators	No. of plants	Production, gal.	Price per gal.	Av. yield gal. per M. cu. ft.
		1911			
Oklahoma	8	8	388,058	5.40	2.68
		1914			
Oklahoma	35	58	17,277,555	6.44	3.01
Kansas	3	3	Not reported		
Total	38	61			
		1917			
Oklahoma	167	234	115,123,424	18.71	1.359
Texas	10	11	6,820,405	15.40	.635
Louisiana	15	20	4,979,754	16.36	2.229
Kansas	4	6	1,174,980	20.53	.126
Total	196	271	128,198,563		

While the older areas of the United States had more plants, the Southwest quickly became the most important source of natural gasoline. In 1911, the Southwest had only the 8 plants in Oklahoma, and there were 168 plants in other areas. By 1914 Oklahoma and Kansas plants accounted for nearly half of the total United States output, although they had only 61 of a total of 286 plants. By 1917 four states of the Southwest had 271 of the 886 plants and they accounted for 60 per cent of the total production of 217,884,104 gal.

The early compression plants, while differing somewhat in equipment, were essentially the same in design with the variations in product specifications dependent on methods of operation and properties of the gas. Two-stage operations were perfected in the early days of the industry. The low-stage phase removed the higher-boiling-point fractions. The uncondensed gas from the low-stage operations would then be compressed to pressures up to 300 psi. and the more volatile liquid fractions from the gas condensed and recovered. Finally the uncondensed gases from the high-pressure operations would be expanded in a cooling coil where



We invite you to write for the bulletins illustrated—WP-1099-B29D on Worthington equipment for Oil Refineries and Natural Gasoline Plants and WP-1099-B42C on Worthington Oil Field and Pipe Line Equipment.

IT'S A BIG NAME IN PETROLEUM

...yet it doesn't own a drop of oil

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The range of Worthington products is "as wide as Texas." Not just pumps—though Worthington pumps are seen everywhere along the path that petroleum follows between the well and filling station.

You'll notice the Worthington trademark on engines, mechanical-drive steam turbines, compressors, power transmission equipment, motors, anti-corrosive specialties, condensers, steam-jet ejectors, hydraulic decoking equipment, dewaxing equipment, refrigerating equipment, and many others.

In all—more than 100 types of products.

All of which suggests the wisdom of centralizing your purchases with Worthington and gaining the advantages of Worthington's unmatched experience and unit responsibility on your supplier's part.

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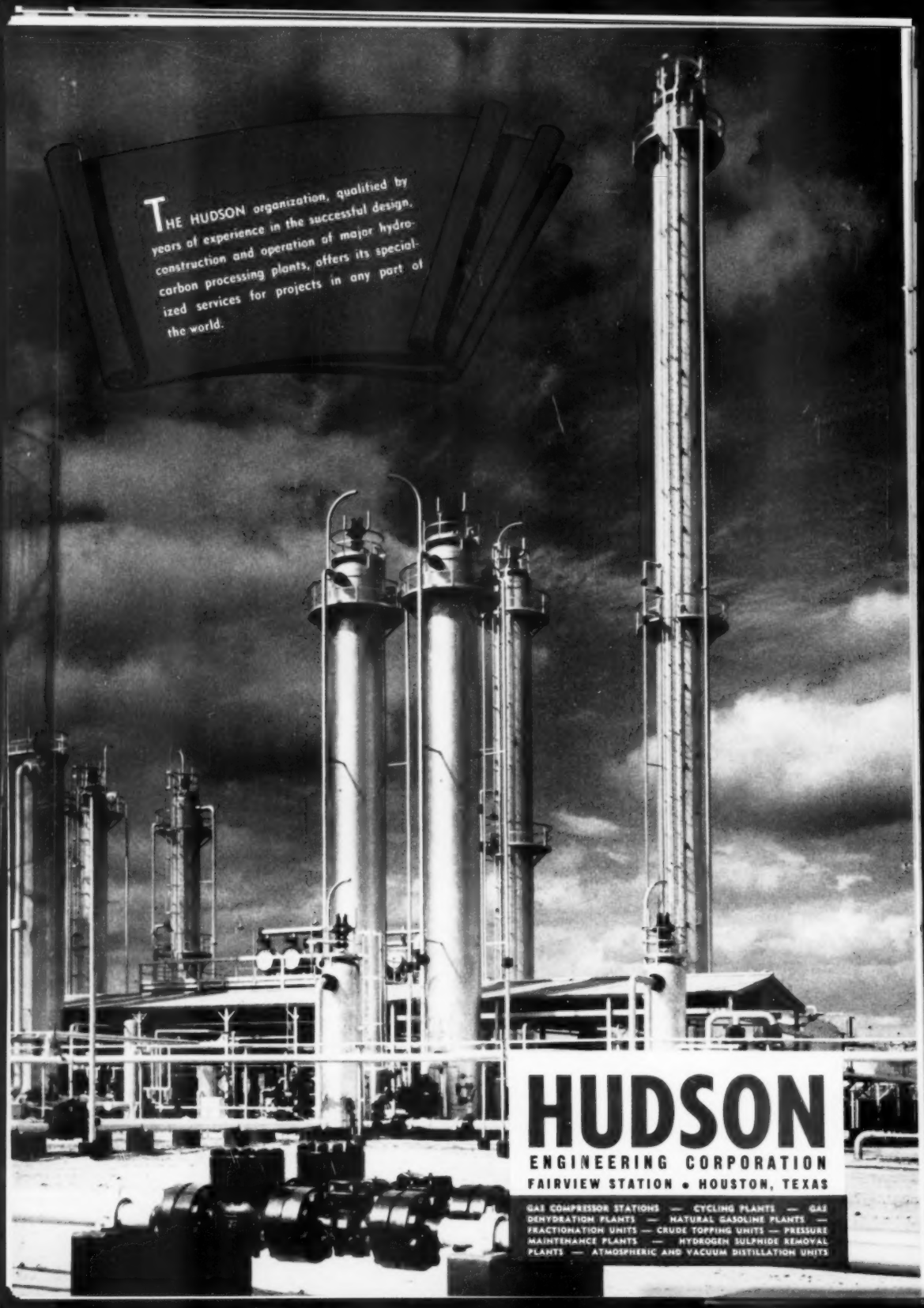
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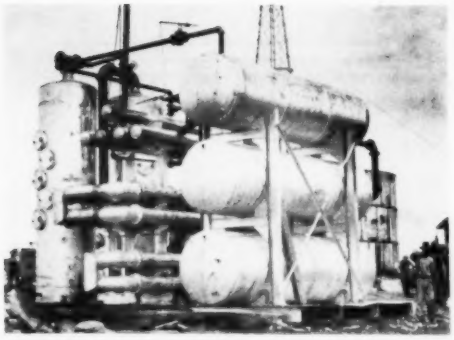
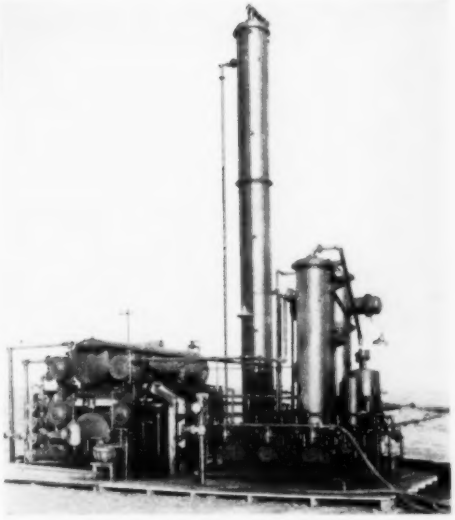




Portability of equipment was stressed during the twenties in many installations of gasoline plants. Operated with well pressure they were quickly installed in new fields and often paid for themselves while the larger, permanent plants were being built. Here are views of a Tulsa-type (now Flint Steel Corp.) unit in operation in the early days of the Seminole, Oklahoma, field (above), and a Hurley Gasoline Co. installation near Ripley, Okla. (right).

small quantities of the lowest-boiling-point liquids would be recovered. The finished product was generally a mixture of the entire operation.

Engine manufacturers soon perfected improvements in their engines and greatly enlarged their capacities. The function of the expansion-type engine was the expansion of the gas from steam engine cylinder to supply the refrigeration which cooled the hot compressed casing-head gases coming from the main compressor. Cooling methods gradually became more efficient. Ammonia refrigeration was tried and several installations were made.

Absorption Method

The most important development previous to World War I was the use of the absorption method in combination with the compression operation. Briefly described, this consisted in contacting the compressed gas with an oil which absorbed the compressed liquids. This was followed by direct or steam distillation in which the liquid products were removed from the absorption oil and fractionated.

Hope Natural Gas Co., a subsidiary of the Standard Oil Co. (N. J.), did some of the early work on this method starting as far back as 1909. Patents were issued to George Saybolt, under whose direction the research and development work was carried on, by the Hope company. The first reported installation in the Southwest was a small plant owned by National Products Co. in a field located near Cleveland, Okla.

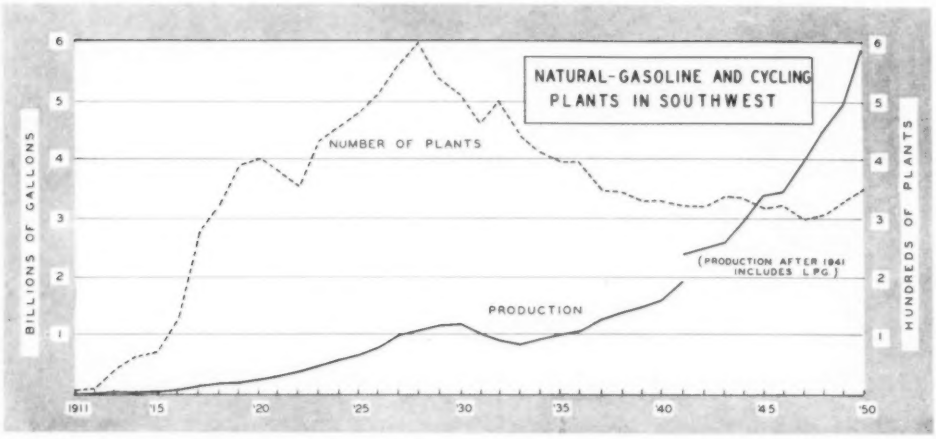
The validity of the Saybolt patents was questioned by some manufacturers who installed absorption equipment at their plants. This resulted in a suit being filed by the Hope company in 1917 against Oklahoma Natural Gas Co., an operator of natural-gas plants and the largest distributor of natural gas in the state. Other manufacturers cooperated with the Oklahoma company in presenting the defense, which attracted wide attention. The defendant company won in the district and appeal courts with the final decision announced in 1922.

The adjudication of this case brought rapid progress in the design of the compression and absorption installations including auxiliary equipment. Outstanding was the application of instrument controls and greatly enlarged capacities resulting in an efficiency in recovery not thought possible in the early days of the industry.

Another patent controversy of major importance both to natural-gasoline manufacturers and refiners had to do with fractionation and condensation of the gases following distillation of the absorption oil or the further processing of the raw product obtained in the compression method still being used by a number of manufacturers.

In brief this operation, which became known as a stabilization or rectification process, was based on the design of fractionating towers which enabled manufacturers to strip the light fractions—propane and part of the butane—from their product and thus meet the market specifications. Previously this had been accomplished with heavy losses largely through "weathering" in storage.

Litigation finally resulted in this art being



thrown wide open for general use by the industry. This development is credited with being a major contribution to the expansion of the natural-gasoline industry, aiding materially in the establishment of the liquefied petroleum-gas division.

Some commentators point to another incident of the first decade of natural-gasoline manufacture as having an important bearing on trends in the Southwest. This was the tragic explosion of casing-head gas from a tank car at Ardmore, Okla., September 27, 1915. Gases from an open tank car became diffused over a large area in the town and in the ensuing explosion 43 lives were lost and 500 people were injured.

Manufacturers, the railroads, and the Bureau of Explosives had long been aware of the special dangers inherent in the transportation and handling of natural gasoline and many safety regulations had been made effective previous to the Ardmore explosion. The tragedy served, however, to strengthen all types of regulations and brought about better testing methods and inspection procedures. Product specifications were standardized.

TANK-CAR RIDE DEMONSTRATES SAFETY IN HAULING

SOUTHWESTERN railroads were skeptical of the new product, casing-head gasoline (now natural gasoline) when it first became available in Oklahoma starting in 1910. There were erroneous beliefs as to how the vapor pressure increased under shipping conditions.

To allay fears, Douglas W. Franchot, Tulsa, in 1912 offered to ride a tank car of natural gasoline from Kiefer, Okla., to the Neodesha, Kans., refinery of Standard Oil Co. of Kansas. The offer was accepted by the Frisco Railroad and Franchot made the trip. He explained afterward he was skeptical himself as to whether he would arrive safely.

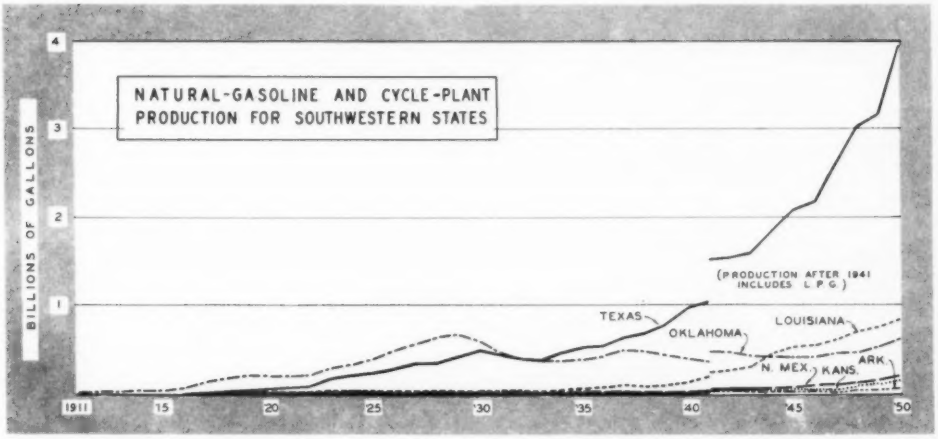
The manufacture of natural gasoline expanded rapidly after this country's entry into World War I in 1917 and for nearly 2 years after the close of the war. There was a threatened shortage of motor fuel for the first time in the history of the petroleum industry. Markets tightened. Natural-gasoline prices in Oklahoma and Kansas advanced to a high of more than 20 cents a gallon for the common grades.

Because of the price levels operators found it economic to install plants in fields where only comparatively small quantities of gas, often lean in gasoline content, were available. Several new high-gravity crude fields were discovered in North and Central Texas and Louisiana as well as Oklahoma and Kansas, and they supplied increasing quantities of gas for new plants. Instances are cited in which new plants during that period had a payout in 90 days.

While many small gasoline plants were built the trend during the war period was toward plants of much larger capacity. With the high prices for the finished products manufacturers offered producers attractive contracts in the purchase of casing-head gas from their wells. Instead of a number of small plants in the larger fields the trend was to build one to three plants in a new field and they processed all the gas available. Often the residue gas from the plants was returned to the sellers for use on the leases for power and fuel.

After World War I

In the language of one of the writers of the twenties, the "bottom dropped out of the natu-



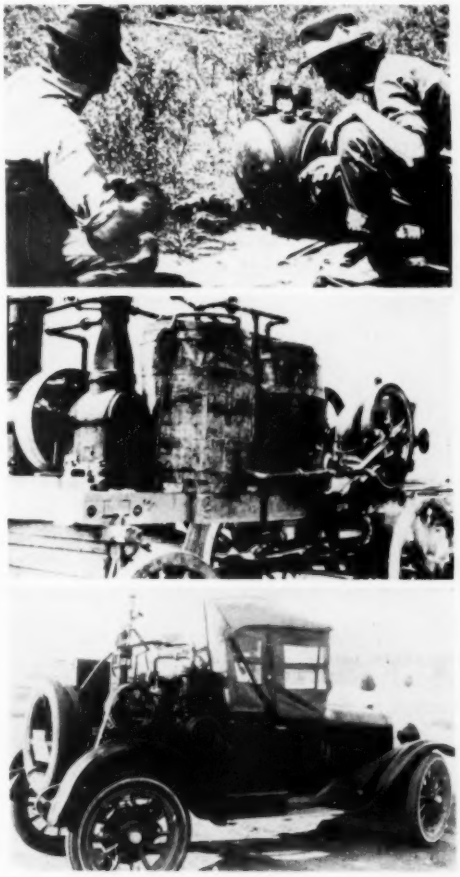
ral-gasoline business" in 1921. Mid-Continent crude prices dropped from $3.50 to $1.00 per barrel and this decrease was preceded by a precipitous decline in prices for refinery and natural-gasoline products. Many natural-gasoline plants shifted from wide profits to substantial losses.

The many problems confronting the gasoline manufacturers resulted in the formation of the Association of Casing-Head Gasoline Manufacturers on April 21, 1921, with headquarters in Tulsa. Thirty-one manufacturers constituted the charter membership.

M. W. Welch, now retired in Tulsa and then general manager of Tidal Refining Co., was the first president. Welch at the time said, "The association was conceived of necessity and born in adversity. We are told we should affiliate with an already organized oil-trade group but our answer is that 'we will not affiliate but we will cooperate!' We are taking the position our problems are peculiar to ourselves and they are neither appreciated nor understood by anyone but ourselves." This became the platform on which, over a period of 30 years, the association membership has carried on many and varied activities.

Within a few months the association approved the recommendation of technical committees and agreed on six blending grades and four motor-fuel grades with definite specifications on initial boiling point, end point, color, vapor tension, and gravity. Uniform testing methods were worked out. There was no way of compelling manufacturers to accept these specifications, but it is a matter of record that within a short time most sales were made in accordance with this grading.

The specifications of products were changed



Three early periods in testing: Top, gravity bottle in use near Nowata, Okla., previous to 1912; center, experimental test car developed by Magnolia Petroleum Co. at Electra, Tex., and, bottom, test car with belt-drive attached to rear wheel of car in use in Oklahoma in 1922.

Cooper-Bessemer

CHAIN REACTION...

going strong since *1899!

THE incredible growth and spread of the oil and gas industry reminds us of nuclear fission. Once started, one thing led to another, ever multiplying in scope. The world's greatest nation, indeed the *whole world,* has benefited enormously by this chain reaction.

Cooper-Bessemer was one of the country's first engine builders to search out ways of solving power problems peculiar to the infant oil and gas industry. In so doing Cooper-Bessemer started its own chain reaction and it's been going on ever since—development after development, paralleling, even anticipating, the industry's growth and changing needs.

To appreciate this you have only to compare our "pride of '99" (the one-lung oil field engine shown opposite) with our latest engines and V-angle compressors—units that, like their many predecessors, are now setting *new* records of performance . . . helping solve the industry's problems *today.*

At this time especially, a *grateful* Cooper-Bessemer salutes the oil and gas industry and extends congratulations to the industry on its brilliant progress during 50 years of oil in the Southwest.

ENGINES AND COMPRESSORS by COOPER-BESSEMER
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**Although Cooper-Bessemer and its products date back to 1833 and were allied with the very earliest oil and gas "activities", the one-lunger shown opposite was one of our first internal combustion oil field engines—a semi diesel. Other milestones included "new-type" Cooper-Bessemer gas engines for Oklahoma's first two natural gasoline plants.*

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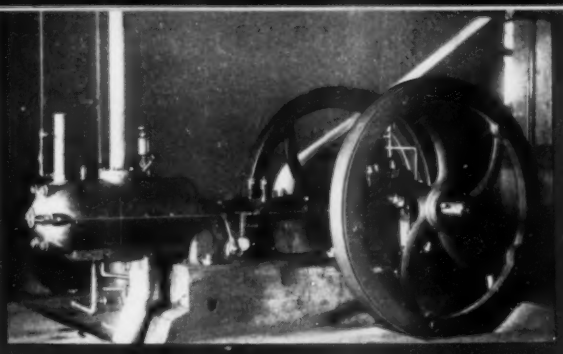
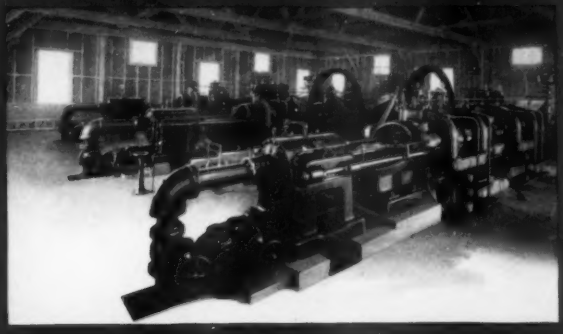
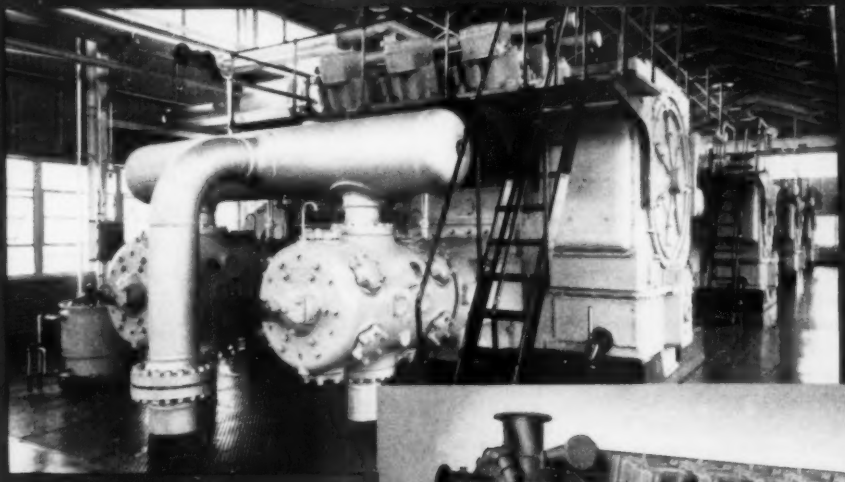
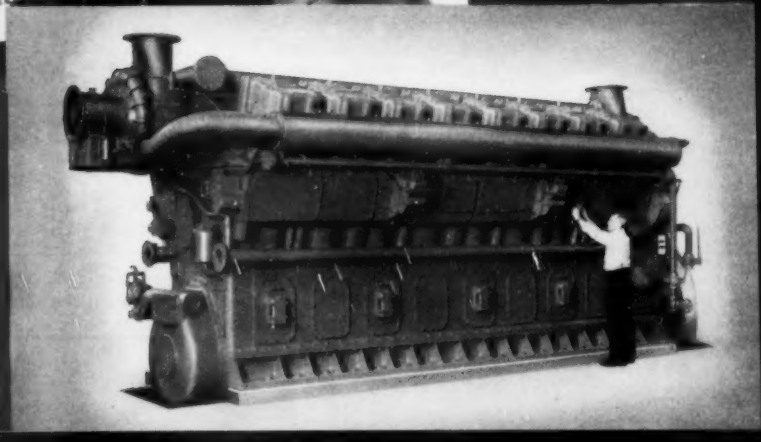
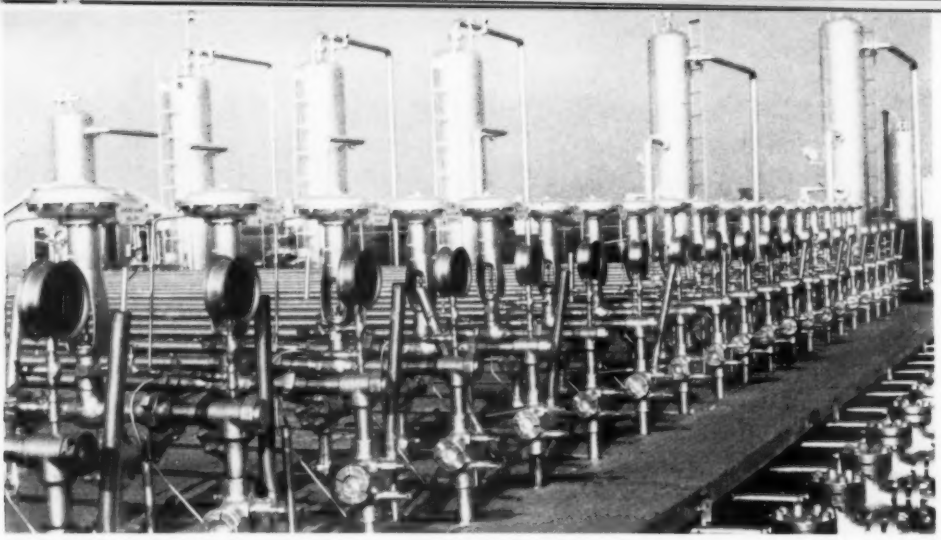








Recently developed V-design of Cooper-Bessemer well-proved type I Superior. Cooper-Bessemer two-cycle gas-diesel and diesel engines are built in a full range of sizes and ratings from 100 to 1700 hp.



Gasoline plant operated in connection with gas maintenance in Esperson Dome, Texas, field, of General Crude Oil Co. View shows equipment used in returning gas to producing sands.

from time to time with a reduction in grades so that shortly the bulk of the natural-gasoline output in the Southwest was manufactured and sold under three to four grades.

There was a lack of uniformity in the contracts between the manufacturers and producers covering the purchase of casing-head gas. Due in part to the seasonal fluctuations in demand and in price structure, it was felt that a graduated scale, based in part on the prices received for the finished gasoline, was a practical and equitable base for the contractual agreements. Changes have been made from time to time in the percentage relationships, but this basic principle is still in effect in a great majority of contracts covering the purchase of gas from both oil wells and natural-gas wells.

While natural-gasoline prices recovered from the lows of the depression period of 1921, it soon became apparent they were not going to return to the war and prewar relationship to refinery motor fuels. Refinery motor-fuel specifications were changed with less emphasis on gravity and greater emphasis on the volatility range from the initial boiling point to the end point. Blenders of natural gasoline and naphtha were not able to duplicate these specifications, and this brought a price disparity which worked a hardship on the gasoline manufacturers.

At about the same time, the gasoline manufacturers began to feel the competition of the increasing quantities of cracked gasolines. The production of these cracked gasolines gave the refiners not only a higher-octane motor fuel but also resulted in the production of greater quantities of light hydrocarbons, previously supplied by the natural-gasoline manufacturers. Large and small refineries installed gasoline-recovery plants and with substantial production of the light hydrocarbons were no longer interested in the purchase of natural gasoline except at prices far below the refinery-gasoline market.

Research Program

This posed a problem for the natural-gasoline manufacturers which brought about research programs, sponsored by the association and by individual manufacturers from which the entire petroleum industry has benefited. Dr. George Granger Brown, then professor of chemical engineering at University of Michigan, was employed in 1926 by the association to carry on research work concerned primarily with the relationship of volatility to motor-fuel

TIMES HAVE CHANGED

THE TEXAS CO., founded in 1902, became interested in the status of the world in matters other than petroleum during that year and in a publication celebrating its fortieth anniversary it pointed out that in 1902:

The national debt was less than 3 billion dollars and there was no income tax and no gasoline tax.

There was no filling station.

Nine thousand cars were produced in the United States but only a small percentage found their way to the Southwest.

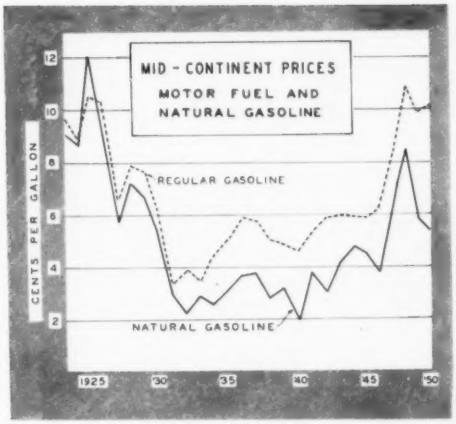
A motorist in New York City was arrested for exceeding 12 m.p.h.

There were more automobiles in Great Britain than in the United States.

WHO SUGGESTED NATURAL GASOLINE?

H. T. ASHTON, manager of the Lubrite Division of Socony-Vacuum Oil Co., Inc., St. Louis, is generally credited with the adoption of the name "natural gasoline" for the output of plants which extract gasoline from casing-head gas. The product for many years was known as "casing-head gasoline."

Manufacturers, starting to get their houses in order following World War I, agreed they should have a new name for their product. They felt that a stigma was attached to the name of casing-head gasoline and that it also no longer reflected the improved properties of the gasoline being manufactured. Ashton, who at that time was in charge of the Tulsa office of Pure Oil Co., suggested the name "natural gasoline," and it was quickly adopted.



performance. This led to work on the part of the U. S. Bureau of Standards, the Society of Automotive Engineers, and the laboratories of the larger oil companies. The studies were not confined to fuels for motor vehicles but extended to include aviation fuels. Extensive road tests were conducted over a period of several years. With all this came changes in engine design which permitted the use of fuels of greater volatility.

A review of the research and development work carried on over a period of 20 years reveals many other developments which have had a bearing on operating methods, transportation, and specifications of finished products. Tests for vapor tension were standardized, uniform gas-purchase contracts were recommended, a workable and yet simple method of testing gas for gasoline content was perfected, and a great deal of work involving standardization of equipment and operating procedure was completed.

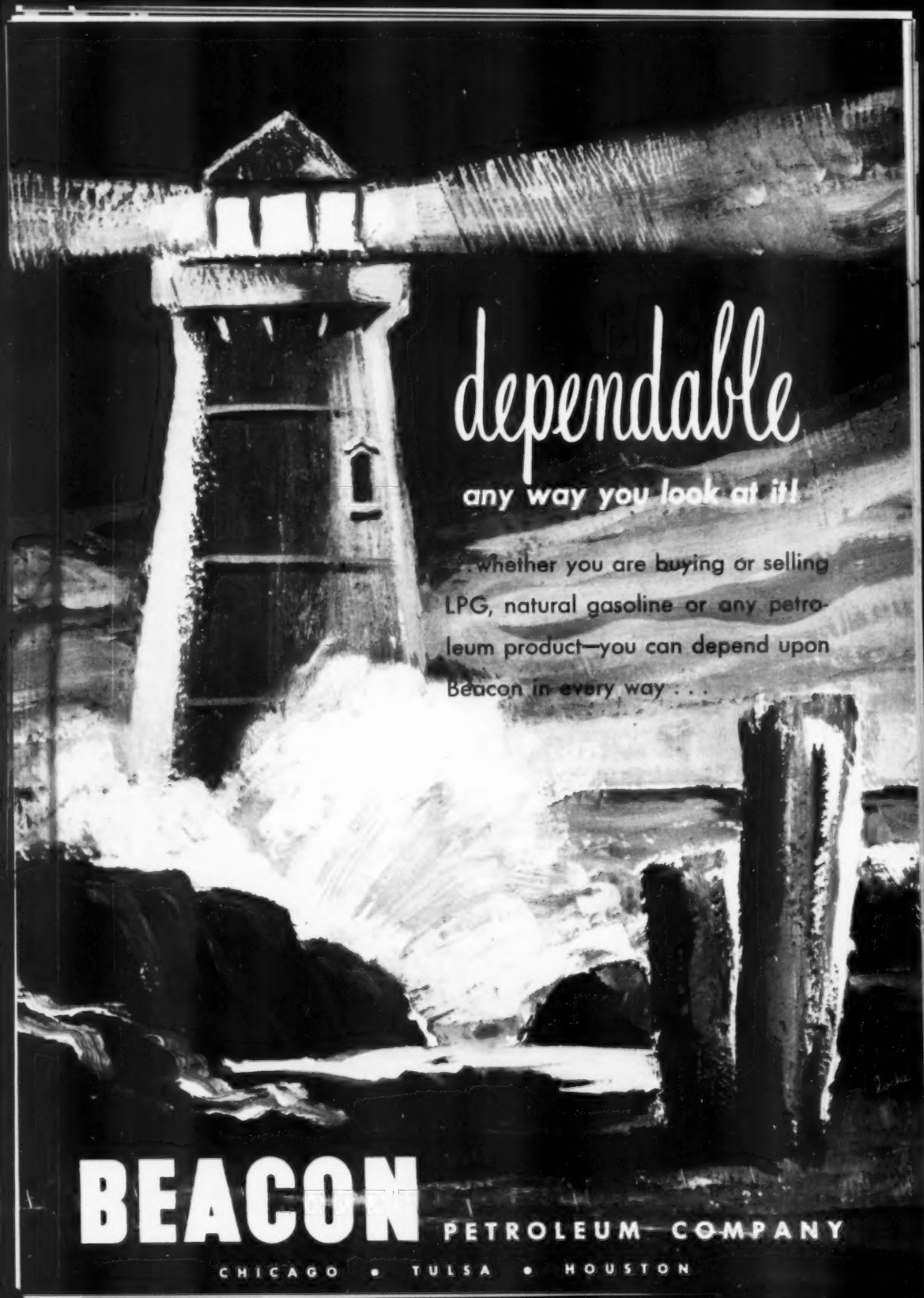
Much of this early work was useful when the natural-gasoline industry started developing the now major branch of liquefied petroleum gases. As a market for these products started to expand rapidly in the late twenties the manufacturers had already available practically all the information that was needed in regard to plant processing practices, bulk transportation and handling, and wholesale and retail channels.

As shown in the accompanying charts and tabular data, there has been a steady expansion in the production of natural gasoline and related products, regardless of market conditions. There have been prolonged periods during the past 30 years in which, from the standpoint of returns, most of the gasoline manufacturers would have been justified in shutting down their plants. The losses from idle plants would have been less than those incidental to operation under distressed market conditions.

However, because of the contractual arrangements with producers, the plants were invariably operated continuously, regardless of price conditions. This unique position of the natural-gasoline manufacturers, in which they must continue their operations regardless of profits, has been further emphasized by trends in the petroleum operations of the Southwest over the past decade. Under the direction of the state conservation bodies, more and more emphasis has been placed on the conservation of natural gas. Because markets were not adequate and because operators were not familiar with modern production methods, large quantities of gas were flared in the development of many fields.

Link in Conservation Programs

Now the conservation bodies are more and more insisting that either the gas be disposed of in fuel markets or that it be returned to producing formations in order to facilitate crude-production operations. The latter operations include pressure maintenance, repressuring, and related operations which have greatly increased the recovery of liquids from reservoirs and have tended to reduce operating costs by prolonging the flowing period of fields. The natural-gasoline manufacturer is an essential link in these conservation programs. His task has been to extract the liquids from the gas and either dispose of the residue to transmission companies or make it available to producers for further use in the production of crude oil. The significance of this trend is shown in the fact that the delivery of gas to large and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small transmission companies with outlets both within and outside the southwestern states has more than doubled in the past 10 years. This development in large measure accounts for the record growth of the natural-gasoline industry over the past 10 years.

Fortunately, due largely to the research work and surveys conducted starting in the early twenties, additional markets have been found for the output of the natural-gasoline plants and prices have recovered from the unsatisfactory levels of the thirties and of 1940. During part of 1940 the principal grade of natural gasoline over a large part of the Southwest in open-market transactions brought less than the posted price for high-gravity crude oil.

Processing methods currently employed in field operations for extracting liquids from natural gas have not been changed appreciably during the past decade. However, application of previously known methods to specific operations, in various combinations, has shown important improvement in operational efficiency in many of today's plants. Not only are the new plants more efficient than those of a few years back, but modernization of many older plants has placed them on a par with those built over the past 10 years.

Since the design and operation of each plant are based on economics, seldom are any two exactly alike. Several factors contribute to these variations, including the composition and conditions under which the natural gas is produced, disposition of residue gas, and the grades of liquids produced. Compared to operations of a decade ago, plants of today are usually designed to process much greater volumes of natural gas. Higher operating pressures are also more common than heretofore as are low-temperature distillation and low-molecular-weight absorption oil.

Central Plant

Although practiced to some degree a number of years ago, central extraction plants operating in conjunction with remote absorbers are being utilized with high degrees of success today. A comparatively new installation of this type is the Garvin County, Oklahoma, project operated by Warren Petroleum Corp., This plant serves a group of major producers in the Golden Trend area.

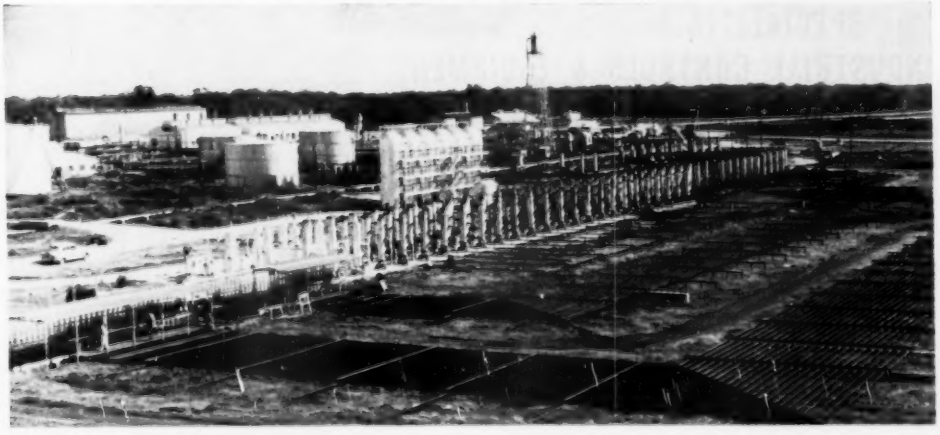
Design of the central plant and its remote units incorporates the latest features. The extraction portion of the extensive plant system is located adjacent to Maysville, Okla., and is designed to produce at the rate of 300,000 gal. of liquid daily. Two remote absorption units supply the central extraction plant with enriched oil. The entire plant system is highly flexible and efficient.

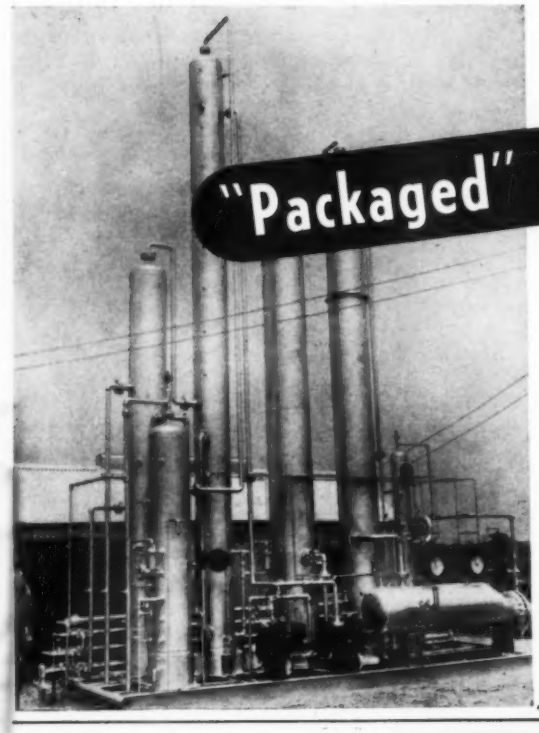
Residue gas from the central plant is delivered to a pipe line. Raw field gas is processed at 40,000,000 cu. ft. daily. Products are natural gasoline, propane, and butane.

While the remote absorber units in the Garvin County installation units are unusual the main processing plant and many of the other operations are typical of other large installations completed since the close of World War II.

Over 200 miles of pipe ranging from 2 to 30-in. is used for gas gathering, gas injections, and other transportation operations. A total of 21,200 compressor horsepower is utilized with ab-

View showing oil-gas separation equipment at the Old Ocean, Tex., plant of J. S. Abercrombie Co. The plant has a rated capacity in excess of 300,000 gal. daily.





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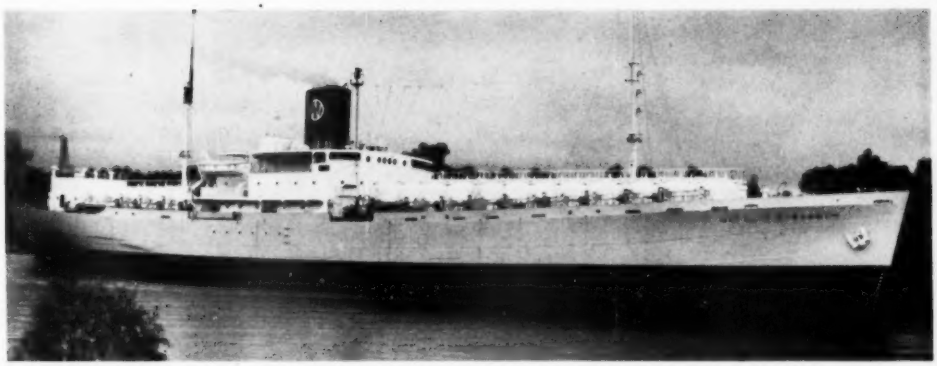

The S.S. "Natalie O. Warren," owned by Warren Petroleum Corp., placed in intercoastal service for the transportation of liquefied petroleum gases in 1947. Capacity 1,386,000 gal.

sorber pressures up to 760 psi. and reservoir injection pressures up to 2,400 psi. An additional 8,655 hp. is used in electric-power generation and auxiliary operations.

The plant consumes several thousand barrels of water daily. In this plant direct-fired heaters are used with radiator-type air coolers. Multistage centrifugal pumps are used in lean-oil service, driven by gas engines.

Automatic Operation

The trend toward automatic operation has been outstanding in recent years. Control through instrumentation covering all phases of operation has been expanded to the point where the number of operators per shift in plants producing from 100,000 to more than 300,000 gal. daily is no greater than in 5,000 to 25,000-gal. plants of 20 to 40 years ago.

Power plant, distillation and fractionating installations, and the utilities and other auxiliary equipment which make the typical gasoline or cycling plant a completely integrated operation compare in efficiency with the most modern of refinery operations.

Special credit goes to the designers and builders of engines and compressors around which all operations of natural gasoline and related activities revolve. As the need for greater horsepower became apparent, manufacturers have steadily increased their ratings until 2,500-hp. units are used at many plants. Cooper-Bessemer Corp., Ingersoll-Rand, and Clark Bros., Inc., are among the companies which, working with the manufacturers, have designed engines and compressors meeting the expanding needs. Centrifugal compressors are being used in low-stage operations at one large plant and centrifugal boosters have proved their value in the transmission of natural gas. The use of electrical power produced at plants with generators directly connected to engines has been a development of the past 20 years which has aided in the solution of auxiliary problems.

According to The Oil and Gas Journal's annual survey in April this year the 318 natural-gasoline plants in the Southwest had a daily capacity of 19,866,970 gal. and 48 cycling plants a capacity of 6,726,000 gal. daily. The products of the plants other than the natural-gasoline grades, motor gasoline, condensate, butane, and propane include in some instances the commercial sale of isobutane, isopentane, hexane, and heptane.

Cycling Becomes Important Production Factor Starting in 1938

THE art of cycling became a factor in the gasoline industry starting in 1938 with the completion of two plants in Texas. One was built by Corpus Christi Corp. in Nueces County and the other was a joint enterprise of Seaboard Oil Co. of Delaware and Tide Water Associated Oil Co. which was located at Long Lake, Cayuga field, East Texas. Cycling consists of extracting liquid hydrocarbons from a wet-gas reservoir by methods employed in the normal gasoline plant and returning the stripped or residue gas continuously to the reservoir where it becomes enriched for subsequent processing under carefully controlled conditions.

The original plants were successful and there has been a steady growth in the output of plants, principally in Texas, since that time. The operation of the cycling plant is similar to that of the standard natural-gasoline plant

Cycling became a commercial operation in 1938. Here are two of the plants that started operating that year: Top, Cayuga field plant, Anderson County, Texas, of Tide Water Associated Oil Co. and Seaboard Oil Co.; bottom, Wardner plant, located in Nueces County, Texas, of Corpus Christi Corp.

except that the output extends from propane to the light condensates. Because the plants produce the heavier fractions, some cycling-plant operations have been adapted to the production of finished motor fuels so that this development has become a direct factor not only in natural-gasoline markets but also motor-fuel markets of refineries.

A cycling program involves the use of large and varied equipment, including compressors, strippers, absorbers, and separators, much of which is designed and built for high-pressure operation. The operation itself is essential to maximum recovery of light hydrocarbons in producing fields.

Cycling operations are conducted in the producing fields themselves. The design, construction, and operation of cycling projects have opened a whole new field of technology and operational practices, particularly in Texas, Louisiana, Mississippi, and Arkansas.

A brief description of the operation of a medium-sized cycling plant (50,000,000 cu. ft. daily) in South Louisiana follows. This medium-sized cycling plant is designed to handle 50,000,000 cu. ft. per day of produced gas, approximately 45,000,000 of which comes from the distillate-producing formation and approximately 5,000,000 from the oil-distillate-producing formation. The former gas enters the plant at about 2,000 psi. and the latter at about 500 psi. After absorption, both of these gas streams are boosted to a pressure of approximately 3,900 psi. for injection back into their respective producing formations.

The plant is designed to recover and store in liquid form no less than 35 per cent of the propane, 80 per cent of the butanes, and 98 per cent of the pentanes plus contained in the total produced gas. The products are propane, mixed butanes, natural gasoline, motor fuel, kerosine, gas oil, and distillate oil bottoms.

To prevent internal corrosion of the high-pressure pipe line and other project equipment, corrosion-inhibitor solution is injected into the high-pressure gas stream at points near each well head. Special well-completion procedures permitted the maximum well-head delivery pressures and consequent minimum retrograde condensation at the surface of the well bore on the production wells. The sand production system is designed for 1,000-psi. working pressure. The gas-injection system, consisting of approximately 3½ miles of 6 5/8-in. o.d. line, delivers gas to the two input wells for the "D" sand. Gas injection into these "D" sand input wells is made at or below the gas-water contact point.

Three absorption-pressure levels are used; the high pressure at 2,000 psi., an intermediate pressure of 500 psi., and a reabsorption pressure of 140 psi. Both the produced streams entering the plant plus each of the vents from the reduced pressure separators and rich-oil flash tanks are treated at one of these three absorption pressure levels.

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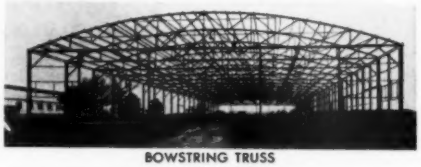

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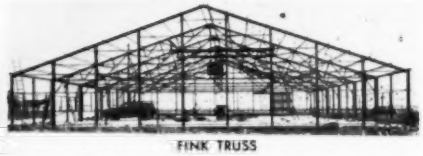

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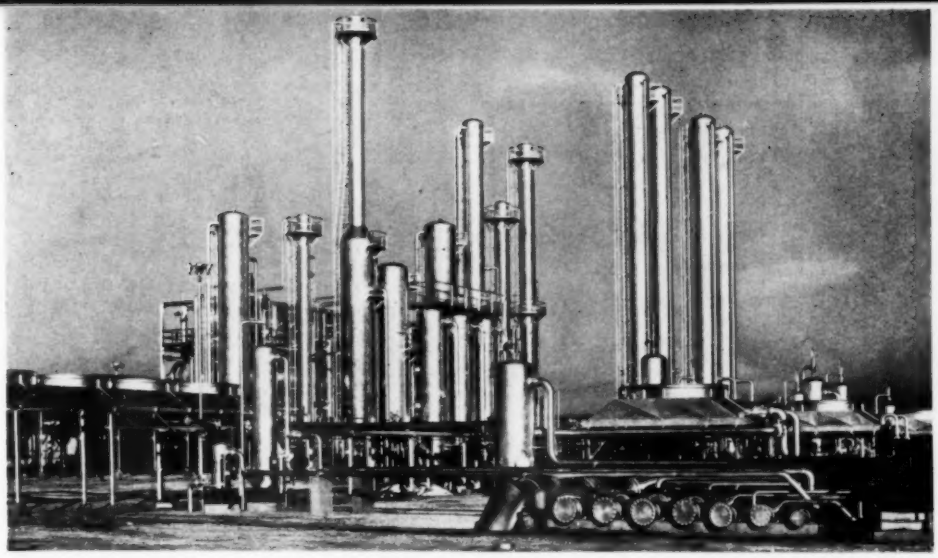


Gulf Oil Corp.'s Eunice, N. M., plant handling 58,000,000 cu. ft. of gas daily. In representative operation, plant recovers 68,000 gal. daily of propane, 27,000 gal. of butane, and 48,000 gal. of natural gasoline.

L.P.G.'s Growth, Percentagewise, Exceeds All Other Divisions of the Industry

NO development in the growth of oil and gas in the Southwest has been more outstanding than has been the expansion of the liquefied petroleum gas industry over the past 20 years. Its percentage of growth from year to year has exceeded all other divisions of Southwest activity.

For many years a byproduct of the natural-gasoline plants, a situation has developed at many plants at which the "tail is wagging the dog" and since the close of World War II the total production of liquefied petroleum gases for the country as a whole now exceeds the output of the regular natural-gasoline grades and natural-gasoline mixtures. In addition there has been a steady increase in the output of L.P.G. at refineries in the United States including practically all of the plants located in the Southwest.

Starting in the late twenties the manufacturers began to give attention to the absence of markets for these light hydrocarbons. The advancements in fractionating design made it possible for the manufacturers to recover both the propane and butane as separate products.

The big problem in the Southwest was not the recovery of the L.P.G. but to find markets. As late as 1927 the reported sale of L.P.G. for the entire country totaled only 1 million gallons. However, sales in 1920 were twice what they were the previous year and starting at that time there was a rapid increase in all uses of L.P.G.

The growth in the Southwest is shown in the following table, based on the latest Bureau of Mines reports available:

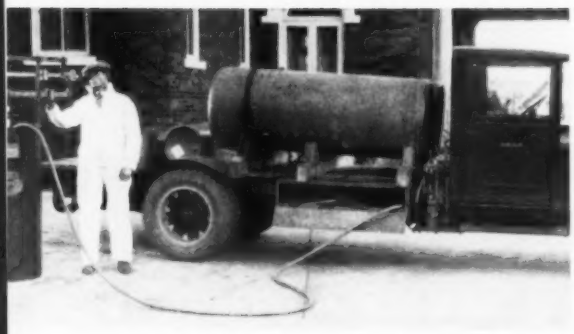
*Production of L.P.G. at Plants**

	1941	1948
	(thousand gallons)	
Arkansas	6,281	39,092
Kansas	12,815	28,617
Louisiana	24,765	179,442
Mississippi		18,339
New Mexico	11,885	31,396
Oklahoma	91,136	197,131
Texas	378,598	1,123,225
Southwest	525,390	1,617,242

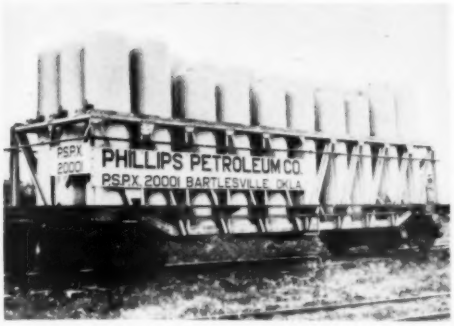
*Confined to production at natural-gasoline and cycling plants and not including refinery output.

In 1948 the southwest plants accounted for 78 per cent of the total production in the United States and due to the rapid growth over the past 2 years it is believed it is now at least 80 per cent of the national total.

There are no data available which give accurately the consumption of L.P.G. within the southwest area. Local consumption absorbs



This is a 1927 method of making a delivery to one of the early users of L.P.G. in the Southwest.



Specially designed high-pressure tank cars now transport liquefied petroleum gases throughout the United States. Twenty years ago the multiunit tanks shown above were being used in transportation.

a substantial part of the total production and the market is expanding rapidly.

All of the larger cities of the Southwest and most of the smaller communities are now connected to natural-gas systems but there are many communities, in addition to the rural areas, which rely on L.P.G. as fuel for all uses. On the farms L.P.G. has become an important fuel for tractors and all farm power. Since a large part of the Southwest is within a 200-mile radius of a source of supply the L.P.G. is delivered at comparatively low prices, particularly where the consumer has storage facilities to handle 5 or more barrels of the product. Usually these deliveries are made by tank trucks which obtain their supplies directly from the 366 natural-gasoline and cycling plants located in the Southwest.

PROPANE-BUTANE PROPELS MOTOR CAR IN 1912

THE use of butane and propane or mixtures of the two as motor fuel is spreading in several fields including buses, trucks, and automobiles. Some have assumed this is an entirely new development.

Such is not the case. Frank Peterson, widely known pioneer of the natural-gasoline industry now retired in Tulsa, tells of an experiment carried on in 1912 shortly after the natural-gasoline industry was born.

Peterson, in association with Dr. Walter O. Snelling and others, installed a pressure-storage tank and mixing valve, replacing the conventional carburetor on a Packard car. The demonstration in New York City showed that the car using a propane-butane mixture gave satisfactory performance. The test attracted attention in the automobile industry at that time. The complications arising from handling the high-pressure fuel in storage and on the car were largely re ponsible for the failure to secure a wide application.

There is also a large demand within the Southwest from utility companies, chemical manufacturers, and a number of other industrial users.

The bulk of the production of L.P.G. in the Southwest is disposed of outside the area through tank car, pipe line, and water transportation. The southwest plants supply most of the large demand within the Middle West and thousands of insulated tank cars are engaged in the transportation of the products between plants and points of distribution.

The principal problem of the manufacturer is the seasonal shifts in demands, particularly in the case of propane. In recent years the demand for propane has exceeded the supply during the winter consuming months, and large excess supplies prevail during the remainder of the year. This has brought large pressure-storage programs at many plants and also the consuming centers. Some applications of underground storage of propane have also been successful.

The national market, largely supplied by southwestern plants east of the Rocky Mountains, is divided 64 per cent domestic, 9 per cent industrial, 7 per cent gas manufacture, and 20 per cent chemical manufacture.

As outlets for L.P.G. have expanded, market conditions for the manufacturer have improved. Prices are still generally below the quotations for natural-gasoline grades but manufacturers believe that this spread will gradually close. In the case of butane it has brought about a situation in which its use as blending material in the production of motor fuels competes with the other demands in which butane is either used as a separate product or blended with propane to secure a commercial fuel.

To Better Serve

The passing of time has brought understandable progress in many great industries . . . but few, if any, have had so little time to prepare for exceptional demand as the suppliers of LP-Gas. The call for LP-Gas from homes, farms, industry and transportation has been so great that few companies have succeeded in expanding facilities even approaching the demand for the product.

Prominent among the leaders has been the Liquefied Petroleum Gas Division of Warren Petroleum Corporation. New plants have been placed in production . . . others enlarged . . . Terminal and Storage increased . . . Rail and Water Transportation expanded . . . Engineering and Research fostered . . . all with one thought in mind . . . TO BETTER SERVE the growing number of customers who depend on Warren for the LP-Gas they need.

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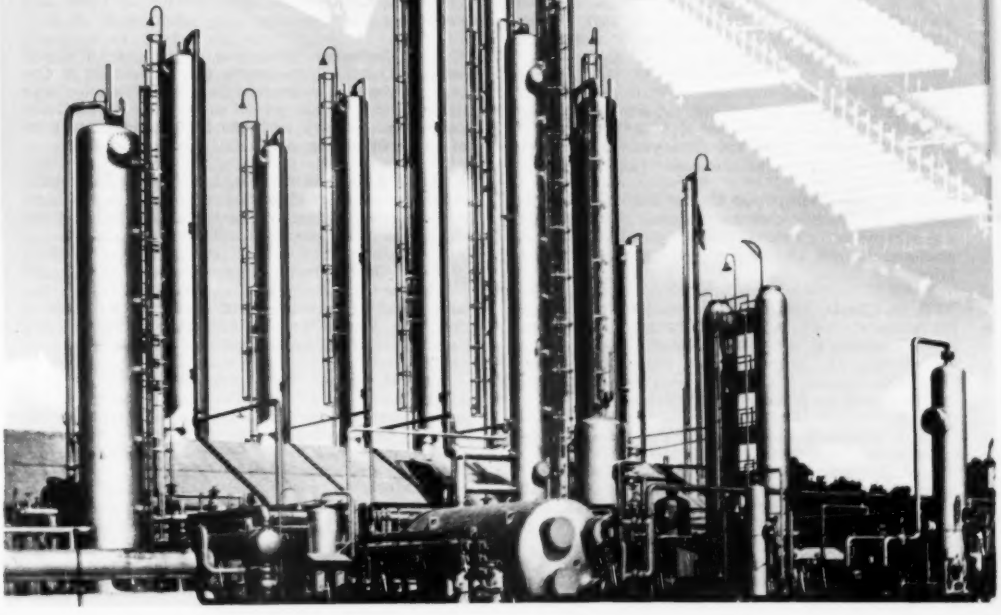


SOUTHWEST Natural Gasoline PERSONALITIES

A robust division of the petroleum industry is that devoted to natural-gasoline manufacture and related operations. The men listed here are among those who have contributed to the division's importance in southwestern oil.

K. S. Adams, chairman of the board of Phillips Petroleum Co., Bartlesville, Okla., joined the warehouse and material department of the firm in 1919. In 1938 he was elected executive vice president of the company, and in April 1938 was elected president. He is a graduate of Kansas University.

Clyde H. Alexander retired as vice president and general manager of Phillips Petroleum Co., Bartlesville, Okla., to operate independently. At 13 he was in the oil industry, driving a lease team in Pennsylvania. He aided in construction of the first cycling plant.

A. W. Ambrose, president of Cities Service Oil Co., Bartlesville, Okla., was a petroleum technologist with the United States Bureau of Mines in 1918. He became president of Cities Service in 1946 after filling several executive positions for 23 years.

W. A. Baden, president of Anchor Petroleum Co., Tulsa, entered the L.P.G. business after graduating from Tulsa University in 1933, and has been connected with the industry ever since. He was one of the organizers of Anchor.

J. W. Black was transferred to Magnolia Petroleum Co.'s natural-gas department in 1923, 4 years after joining the company. He is now assistant to the manager of that department in Dallas.

George P. Bunn, manager of Phillips Petroleum Co.'s natural-gasoline and gas department, Bartlesville, Okla., graduated from Kansas University in 1920 and joined Phillips the same year. He is a past president of Natural Gasoline Association of America.

J. O. Campbell joined Carter Oil Co., Tulsa, in 1939 as a junior petroleum engineer. Now general superintendent of natural-gas and gasoline plants, he attended Illinois University and Missouri School of Mines.

R. A. Carter, general superintendent of Stanolind Oil & Gas Co.'s gas department, Tulsa, formerly was superintendent in charge of the natural-gasoline and gas division of Continental Oil Co. at Ponca City, Okla. He started his career with Lone Star Gas Co. and later went with Skelly Oil Co.

D. L. Connelly, president and director of Warren Oil Co., Houston, first entered the oil industry at Barnsdall, Okla., as clerk for National Supply Co. in 1920. He became a scout and landman for Gulf Oil Corp. in 1922, and in 1944 became oil-production manager for Warren Oil.

Emery Edgar DeBack was widely recognized as an authority on gas recycling. He was vice president of Stratton Pipeline Corp., and general superintendent of Coastal Recycling Corp., The Chicago Corp., and Gulf Plains Corp., Corpus Christi. (Died 1942).

C. P. Dimit, vice president in charge of production and a director of Phillips Petroleum Co., Bartlesville, Okla., started with National Supply Co. He joined Gulf Pipe Line Co. of Oklahoma in 1916, and after 13 years transferred to the old Gypsy Oil Co. In 1929 he became director and vice president of Independent Oil & Gas Co., and went with Phillips in 1931.

J. H. Dunn, before going with Shamrock Oil & Gas Corp., Amarillo, was chief production engineer for Lone Star Gas Co. A graduate of Texas A. & M. College, he began his career as an orifice-meter inspector with Lone Star. He is now president of Shamrock.

Donald B. Edwards, Tulsa, stepped up to chief engineer of Stanolind Oil & Gas Co.'s manufacturing department in 1950. He joined the firm as assistant chief gas engineer in 1946 and is a graduate of Rice Institute.

H. E. Felt joined Warren Petroleum Corp., Tulsa, in 1930, and shortly afterward became secretary. Formerly with Atlantic Refining, he is now vice president in charge of Warren's L.P.G. division.

Julian L. Foster, general superintendent of Lone Star Gas Co.'s division of transportation, is also general superintendent and director of Lone Star Producing Co.

J. L. Gallagher, Tulsa, was named general superintendent of plant operations for Sinclair Oil & Gas Co. last year. A veteran of 34 years of service with the company, he has served as stillman at the Cushing, Okla., refinery and has held various positions in other Oklahoma plants.

Allen T. Givens, Monroe, La., is gasoline-division superintendent for Coltexo Corp. He is a graduate of Louisiana Polytechnic Institute, and entered the natural-gasoline business in 1929.

T. R. Goebel had been associated with Sinclair Oil & Gas Co., Skelly Oil Co., and Shell Oil Co. before becoming vice president of Columbian Carbon Co., New York City. He is past president of the Natural Gasoline Association of America.

Otha H. Grimes, Tulsa, went in business for himself in 1921, and a year later Grimes Gasoline Co. put its first natural-gasoline plant in operation. He formerly did gas-engineering work for the old Oklahoma Petroleum & Gasoline Co.

R. D. Hanley, vice president of Magnolia Petroleum Co., Dallas, started his career with Magnolia Gas Co. in 1925. He is also a director of Magnolia Petroleum.

Don D. Harrington, Amarillo, president of Panoma Corp., began his career in the engineering depart-

ment of Standard Oil Co. (N. J.) in 1919. He joined Marland Oil Co. later, quitting in 1926 to form a partnership in Amarillo. In 1949 he formed Panoma, which operates 2 gasoline plants and 200 gas wells.

H. W. Harts, Tulsa, got his start in the oil business with Amerada Petroleum Corp. in 1921, becoming construction superintendent in 1925. He is now vice president of manufacturing for Warren Petroleum Corp.

Frank C. Henderson was a veteran of Spindletop and built the first casing-head-gasoline plant in the Mid-Continent area at Nowata, Okla. Later he built the first high-pressure recycling plant on the Gulf Coast at Agua Dulce field, Texas. (Died 1943).

Chesley C. Herndon, Tulsa, has been executive vice president of Skelly Oil Co. since its organization in 1919. He practiced law in Tennessee and Oklahoma from 1909-19. The company is a large manufacturer of natural gasoline.

J. A. LaFortune, Tulsa, executive vice president and a director of Warren Petroleum Corp., formerly was with Standard Oil Co. (Ind.). He is past president of Natural Gasoline Association of America and is a director of Oklahoma Natural Gas Co.

T. W. Legatski, assistant director of research at Bartlesville, Okla., for Phillips Petroleum Co., joined the firm's technical staff in 1925 following graduation from Michigan University. He later became resident director of research at Phillips, Tex.

John F. Lynch became president of La Gloria Corp., Corpus Christi, in 1947 after having been associated with Shamrock Oil & Gas Corp., Amarillo, and Fletcher Oil Co., Los Angeles.

H. W. Manley, recently named vice president of Sunray Oil Corp., Tulsa, formerly was manager of its gas-gasoline department. A graduate of Oklahoma A. & M. College, he joined the old Barnsdall Oil Co. as engineer in 1929.

J. R. McWilliams was appointed executive vice president of Carter Oil Co., Tulsa, in 1948. He served as a petroleum coordinator during World War II, and was formerly with Skelly Oil Co., Tulsa. The company is a large producer of natural gasoline.

Frank Metheny, Fort Worth, is vice president and general manager of Sid Richardson Gasoline Co. and Sid Richardson Carbon Co. He started in the oil industry as a roustabout after graduation from Oklahoma University, and worked up to assistant division superintendent of Phillips Petroleum Co. He served as assistant manager of the gasoline department during World War II and joined Richardson in 1947.

Morris E. Mockley, Tulsa, president of Canal Refining Co. and Anchor Gasoline Corp., previously had been supervisor of Amerada Petroleum Corp.'s gasoline-plant division, and president of Natural Gasoline Corp. (Died 1950).

W. B. Moran, president of J. E. Crosbie, Inc., Tulsa, started working for The Texas Co. in 1916 during summer vacations. A graduate of Notre Dame University, he continued with the firm until 1927 when he joined Crosbie. The firm was incorporated in 1928 and Moran was named vice president. He was named president in 1938 and held this position until the company was recently sold.

I. Earl Nutter, general superintendent of operations for Panoma Corp., Amarillo, formerly was with Phillips Petroleum Co. He modified Panoma's natural-gasoline plant in Carson County, Texas, in 1937, and in 1947-48 designed and supervised the advanced plant near Hooker, Okla.

John T. Oxley, president of Texas Natural Gasoline Corp., Tulsa, formerly was secretary and assistant treasurer of Warren Petroleum Corp. He first joined Amerada Petroleum Corp. after graduation from Tulsa University.

Frank M. Perry, manager of the natural-gasoline and chemical division of Cities Service Oil Co. (Del.), Bartlesville, Okla., became a junior engineer for a Cities Service subsidiary in 1919 and has been associated with the organization since.

L. G. Rheinberger, Tulsa, is vice president in charge of gasoline-department operations for Sinclair Oil & Gas Co. He is also a member of the board of directors, and formerly was superintendent of contracts and measurements.

E. H. Salrin, vice president and director of Tide Water Associated Oil Co., Houston, first entered the oil business in 1914 for Oklahoma Oil Co. in Tulsa. He was named secretary in 1920, and in 1922 was elected secretary-treasurer of Tidal Oil Co. He was named vice president in 1926, and since 1936 has been serving as vice president and director of Tide Water Associated.

T. K. Smith, Tulsa, was a pioneer manufacturer of natural gasoline and the inventor of equipment widely used in the oil industry. He was president of Pioneer Corp. (Died 1936).

J. O. Sue, superintendent of the natural-gas and gasoline department for Humble Oil & Refining Co., Houston, joined the company as a clerk. In 1929 he was moved to Houston and in 1935 received appointment to his present position.

R. W. Thomas, formerly vice president and general manager of Philgas Co., and president of Hycar Chemical Co., Bartlesville, Okla., is now vice president of research and development for Phillips Petroleum Co. He joined the organization in 1926.

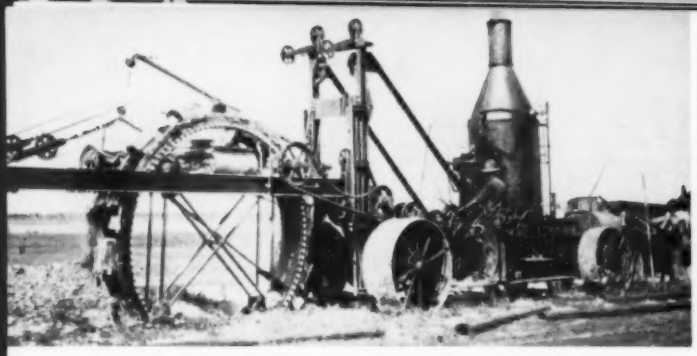
J. W. Vaiden, vice president of manufacturing and research for Skelly Oil Co., is a graduate of Alabama Polytechnic Institute, and started as a laborer for Skelly in 1924. He is a past president of Natural Gasoline Association of America.

William H. Vaughan, superintendent of gas utilization for Tide Water Associated Oil Co., Houston, is in charge of gas operations in the Mid-Continent area. He pioneered gas-cycling operations, and became affiliated with Tide Water in 1936.

Albert H. Weil, general superintendent of the gasoline and chemical department of United Gas Pipe Line Co., Shreveport, during the war was attached to the Corps of Engineers on the Manhattan Project at Oak Ridge, Tenn.

Harry Wheeldon, vice president of Shamrock Oil & Gas Corp., Amarillo, is a graduate of Texas A. & M. College. He formerly was superintendent of Lone Star Gas Co.'s natural-gasoline plants before joining Shamrock.

C. R. Williams joined Continental Oil Co. in 1929 and remained with that firm until 1942. A graduate of University of Oklahoma, he is now vice president in charge of operations in the oil and gas division for The Chicago Corp., with headquarters in Corpus Christi.



Left: Early-day ditcher in operation near Dallas for Lone Star Gas Co. Right: Modern ditcher powered with diesel engine digging ditch for 20-in. crude-oil line in West Texas.

Left: Pipe-bending machine using hydraulic jack and two rollers at work for the Oklahoma Pipe Line Co. in Oklahoma during the early twenties. Right: Bending 12-in. pipe in 1950 for Great Lakes Pipe Line Co. near Barnsdall, Okla. Diesel tractor with side boom used.

On the Line

Southwest Is

by C. O. Willson

A HALF-CENTURY ago pipe-line transportation in the Southwest consisted of gathering lines for one refinery in Texas, a slightly larger system for a Kansas refinery, and natural-gas transmission confined to a few towns in southeast Kansas.

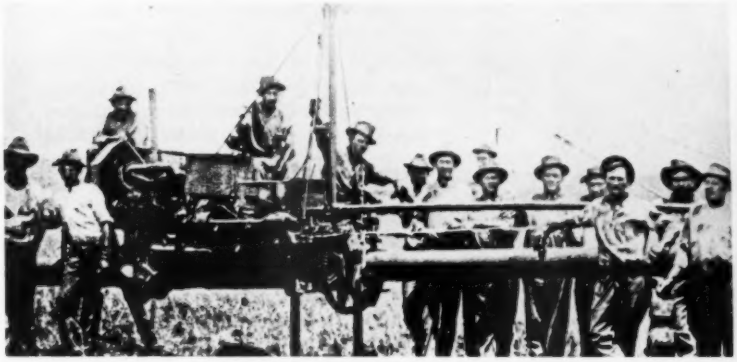
Today as shown by the accompanying crude-oil and product map and a second map of gas systems in the Natural Gas Section, transportation for liquids and gas extend to all parts of the Southwest and from that area in many instances lengthens to the North, East, and West.

Starting with the Spindletop period there has been a steady growth in all phases of crude-oil transportation supplemented by a comparable expansion in ocean-going and inland water facilities to the end that southwestern petroleum finds its way to most domestic outlets and widely scattered world markets. Product transportation by pipe line became an important factor starting two decades ago.

Natural-gas transmission, which is discussed in a separate section of this publication devoted to that development, blankets the Southwest and in a spectacular expansion of recent years now extends to most of the large consuming centers of the Middle West and East with important outlets in part of the Rocky Mountain area.

The activities of the predecessors of the

Left: Applying coating by hand on 20-in. line of the Lone Star Gas Co. in Texas in the early thirties. Right: Coating machine operated in 1950 on 26-in. gas line of Cities Service Gas Co. between Hugoton field and Kansas City.



Left: Texas Pipe Line Co. lays threaded coupled 8-in. line to Goose Creek field in 1917. Machine of early design turns pipe. Right: Welding the 20-in. crude-oil line in 1949 of Magnolia Pipe Line Co. from Texas to Illinois.

Hub of the Pipe-Line Industry

present Texas Co., Gulf Oil Corp., and Sinclair Pipe Line Co., are typical of the pipe-line operations of several companies in the Gulf Coast within the decade following the Spindletop discovery.

J. S. Cullinan and associates and Hogg-Swayne Syndicate, a producing concern, organized Texas Fuel Co. within 3 months after the Spindletop discovery. In January 1902 plans were under way for the construction of a pipe line and refinery. Crude oil was purchased as low as 3 cents a barrel.

W. J. (Jack) Ennis built the 20-mile line from Spindletop field to a point near Port Arthur where the refinery was to be built and which had water-shipping facilities. On May 16, 1902, 5,865 bbl. of crude was run through the 6-in. line. Within 2 years the system of the company which became The Texas Co. in 1902 had extended its pipe-line system to Sour Lake.

With an assured supply The Texas Co. purchased its first tanker, "Florida," for coastwise movement. It had a capacity of 15,000 bbl. with a speed of 12 m.p.h.

In 1905 The Texas Co. connected to the new Humble field where nearly 3 million barrels of oil was in storage. The terminal for this field was near Houston. The company also started the construction of a line from the new Jennings, La., area to Beaumont. Large shipments were made from the pipe-line terminals by tank car as well as by tanker.

J. M. Guffey Petroleum Co., predecessor of Gulf Oil Corp., was organized in May 1901

Backfilling line of Cities Service Oil Co. in Oklahoma in 1917.

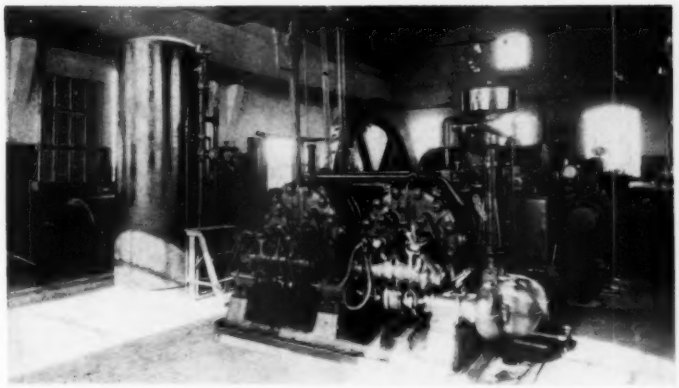
Bulldozer backfilling 30-in. natural-gas line of Transcontinental Gas Pipe Line Corp. in Mississippi in 1950.

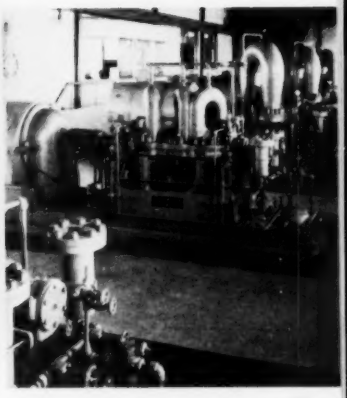
and acquired properties in Spindletop field and also 16 miles of 6-in. pipe line from Spindletop to Port Arthur which had been started by the Guffey interests. Other transportation facilities of the new company included 100 iron tank cars of 150-bbl. capacity each and 1,000,000 bbl. of iron tankage. After the refinery was enlarged, starting in 1902, the capacity of the pipe line was increased.

Major Construction

The Gulf and the Texas companies within a period of a year both decided to extend their pipe-line systems to the new Glenn pool in Oklahoma, then part of the Indian Territory. This represented major pipe-line construction for that period. The 413-mile, 8-in. Gulf line from Glenn pool to the Sour Lake area in Texas was completed in 1907 and deliveries started.

Old and new in pipe-line patrolling. At left is P. L. Martindale showing what the well-dressed line walker wore in 1922. Employed by Oklahoma Pipe Line Co. (now Interstate Oil Pipe Line Co.), his equipment included cleaning irons and safety belt, a 45-caliber pistol, telephone instrument, wire stretcher, pliers, and a long-nosed spade called a "sharpshooter." Other tools for digging out and repairing leaks were usually stored at farmhouses or safe hiding places along the line. At right is plane in service of Interstate Oil Pipe Line Co. carrying on routine pipe-line patrolling in Mississippi.





Left: Early reciprocating pumps at the Augusta, Kans., station of Oklahoma Pipe Line Co. (now Interstate Oil Pipe Line Co.). Right: Modern centrifugal pump installation at the Cushing, Okla., station on the 22-in. line of Ozark Pipe Line System.

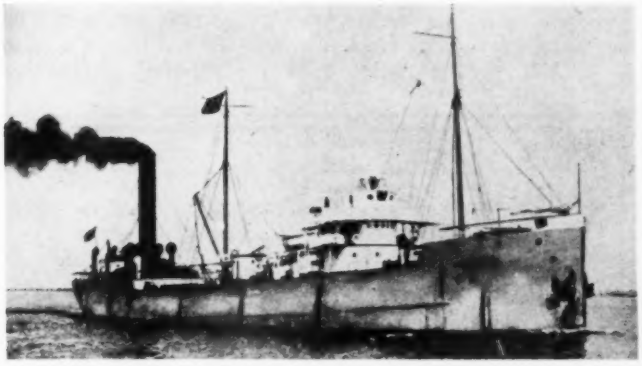
The Texas Co. in the fall of 1906 approved the "hazardous and costly undertaking" and started a pipe line from Glenn pool to connect with its Gulf Coast system. Historians of the company agree that this was a major step in the development of the company which, within a few years, was to become one of the first 10 oil concerns of the entire world.

For the construction of this line, the company purchased 430 miles of 8-in. pipe from National Tube Co. At the same time, to take care of this large expenditure, the capital stock of the company was increased from $6,000,000 to $12,000,000.

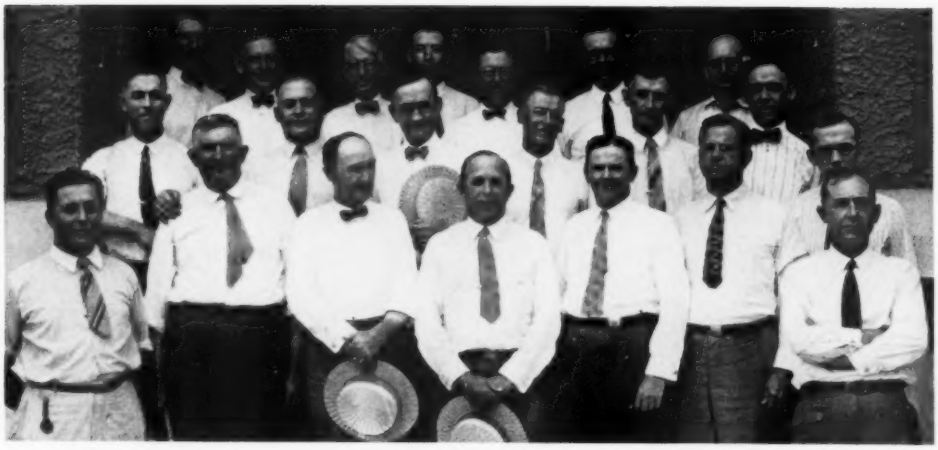
The total length of The Texas Co. line, which was completed in September 1907, was 472 miles. A representative pump station consisted of two 37,500-bbl. tanks, four 175-hp. boilers, and three steam pumps. Twelve of these stations were installed on the line. One crew started laying line south from West Tulsa and one south from Red River. They started deliveries through the line in March 1907 but the line was not finally completed until January 1908. The pipe-line tariff from Glenn pool to Port Arthur made effective at that time was 47½ cents a barrel in contrast to the prevailing rate of 60 cents for rail transportation.

There was another milestone in the history of The Texas Co. in that year marked by the launching of the new tanker "Texas" which was placed in regular service between Port Arthur and European ports.

Incidentally, reports show that in this same year the company started to pay its employes by check rather than cash. This was recommended by a Port Arthur bank which pointed



Left: Steamship Paraguay, first tanker of Sun Oil Co., with cargo of Spindletop crude en route to Marcus Hook, Pa., refinery of the company. Tanker, which had a capacity of 18,000 bbl., was a refitted Great Lakes ore boat. Right: Modern 146,000-bbl. tanker of Atlantic Refining Co. used in crude-oil transportation service between Gulf Coast and Philadelphia refinery. Named in honor of E. H. Blum, vice president in charge of company's southwestern operations.



Pipe-line committee of Texas Pipe Line Co. holds meeting at Port Arthur, Tex., refinery of The Texas Co., June 25, 1926. In the first row center is B. E. Hull, head of the pipe-line company and often designated "dean of the pipe-line industry." Others shown in picture are: Back row, F. P. Dodge, T. J. McMahon, R. J. Daniel, O. R. Burden, J. B. Haden, J. H. Borchers, and H. M. Snyder. Second row, B. C. Walker, C. O. Crouch, H. L. Stewart, O. E. Stimson, J. C. Colligan, and W. A. Bohan. Front row, Charles Benson, T. J. Hannon, J. K. McGoldrick, Hull, J. L. Dowling, A. M. Donoghue, R. B. McLaughlin, and J. B. Allsman.

out this practice would reduce the currency requirements of the bank and also encourage employes to open both checking and savings accounts.

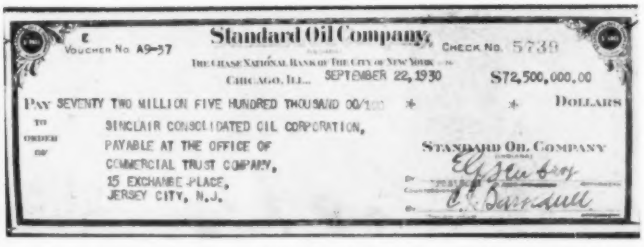
The Texas Co. expanded its pipe-line facilities rapidly during the decade following the Spindletop discovery. By 1910 it was operating 1,000 miles of telephone and telegraph lines, and its southwest pipe-line system connected to refineries at West Tulsa, Okla., and West Dallas, Port Arthur, and Port Neches, Tex., with a combined capacity of 30,000 bbl. daily. To handle shipments from the refineries and the water terminals the company had 1,010 tank cars, 5 ocean-going tankers, 9 ocean-going steel barges, 10 wooden barges, and 2 tugs. In the same year the company authorized the construction of a 200-mile, 8-in. pipe line from Artis, La., on the Texas boundary, to the Port Arthur refinery.

Indicative of how quickly the new oil supplies of the Southwest became important in world markets, through transportation, The Texas Co. by 1913 was marketing petroleum products in 77 countries through 60 ocean terminals and 180 distributing stations.

Burt E. Hull

The pipe-line activities of The Texas Co. are interwoven with the many and varied activities of Burt E. Hull, who has had a major part in all pipe-line construction and operation in which the company has been the owner or part owner.

Hull, who is an engineering graduate of Texas A. & M. College, saw the first pipe line built out of Spindletop starting in 1901. He joined The Texas Co. in 1905 and his first job was to assist in laying a line from Beaumont to Humble field. The following year he sur-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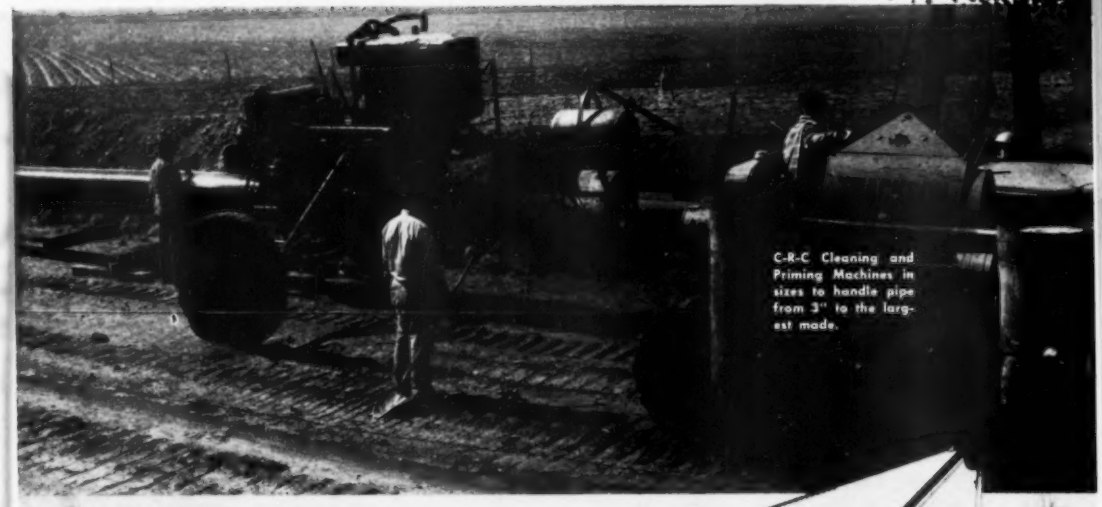

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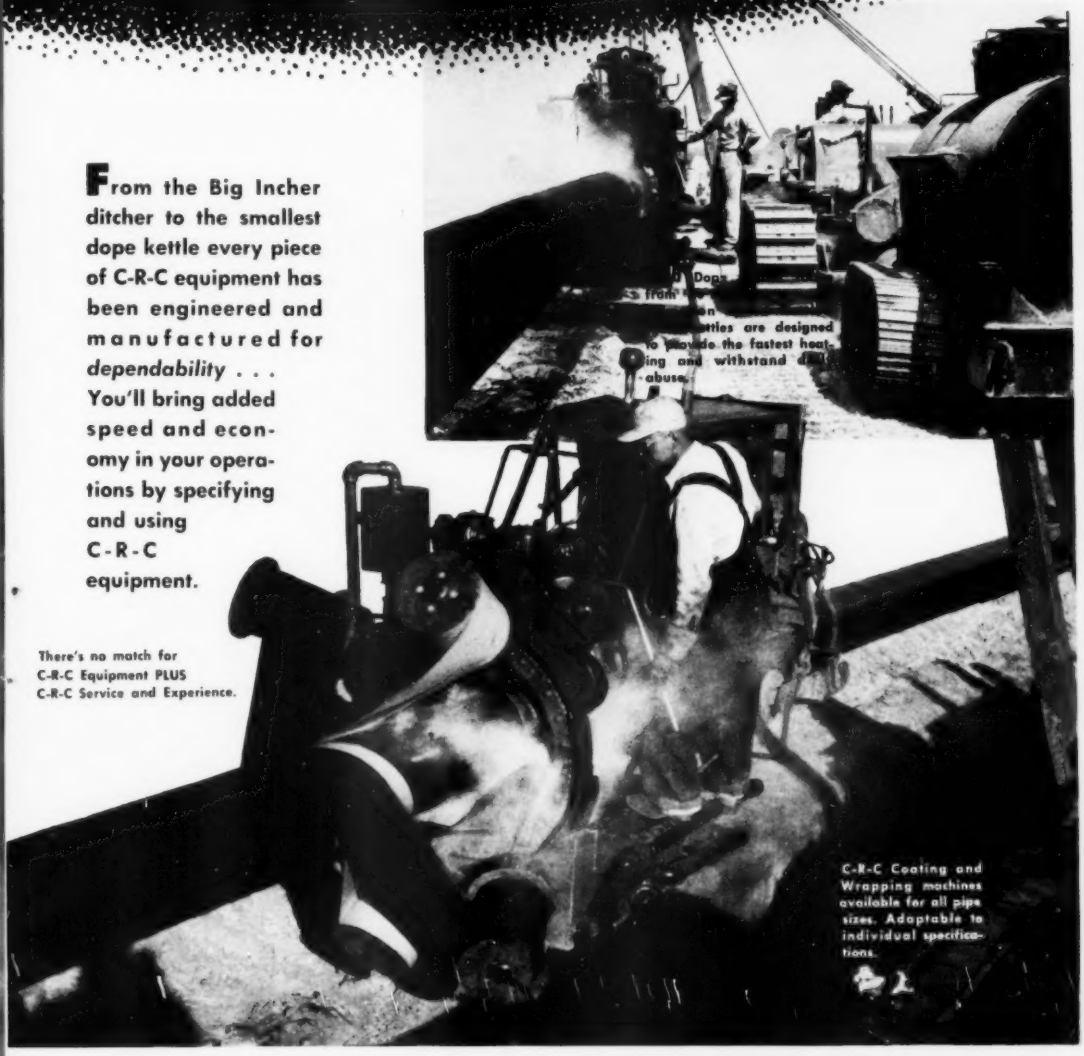

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Laying of pipe lines until the twenties was largely done by manual labor. This is a scene on the 8-in. line of Texas Pipe Line Co. between Glenn pool in Indian Territory and company's Port Arthur refinery. It was one of the two first long-distance pipe lines of the Southwest.

veyed the line from Beaumont to Lake Charles, La., later extended to Jennings field, Louisiana. He also made the survey of the line to Glenn pool in Indian Territory. Later he became president of Texas Pipe Line Co. and was in charge of its expansion into one of the largest pipeline systems in this country.

During World War II Hull was in charge of the construction of the 24 and 20-in. Big and Little Inch lines extending from Texas to the eastern seaboard. Recently he completed the laying of a 30-31-in. line, as president of Trans-Arabian Pipe Line Co., from the Persian Gulf in Arabia to Sidon, Lebanon, on the eastern Mediterranean.

Prairie a Pioneer

Prairie Oil & Gas Co. was the pioneer pipeline builder of the Mid-Continent. The pipe-line operations were later carried on under the name of Prairie Pipe Line Co. for many years. In 1932 the system was absorbed by the Sinclair interests and the early-day operations are now a part of the vast national pipe-line system of Sinclair Pipe Line Co., owned by Sinclair Oil Corp.

The Prairie company in 1903 built a 32-mile, 6-in. line to connect the early Chanute and Humboldt fields in Kansas with the refinery which had been built by Standard Oil Co. at Neodesha, Kans.

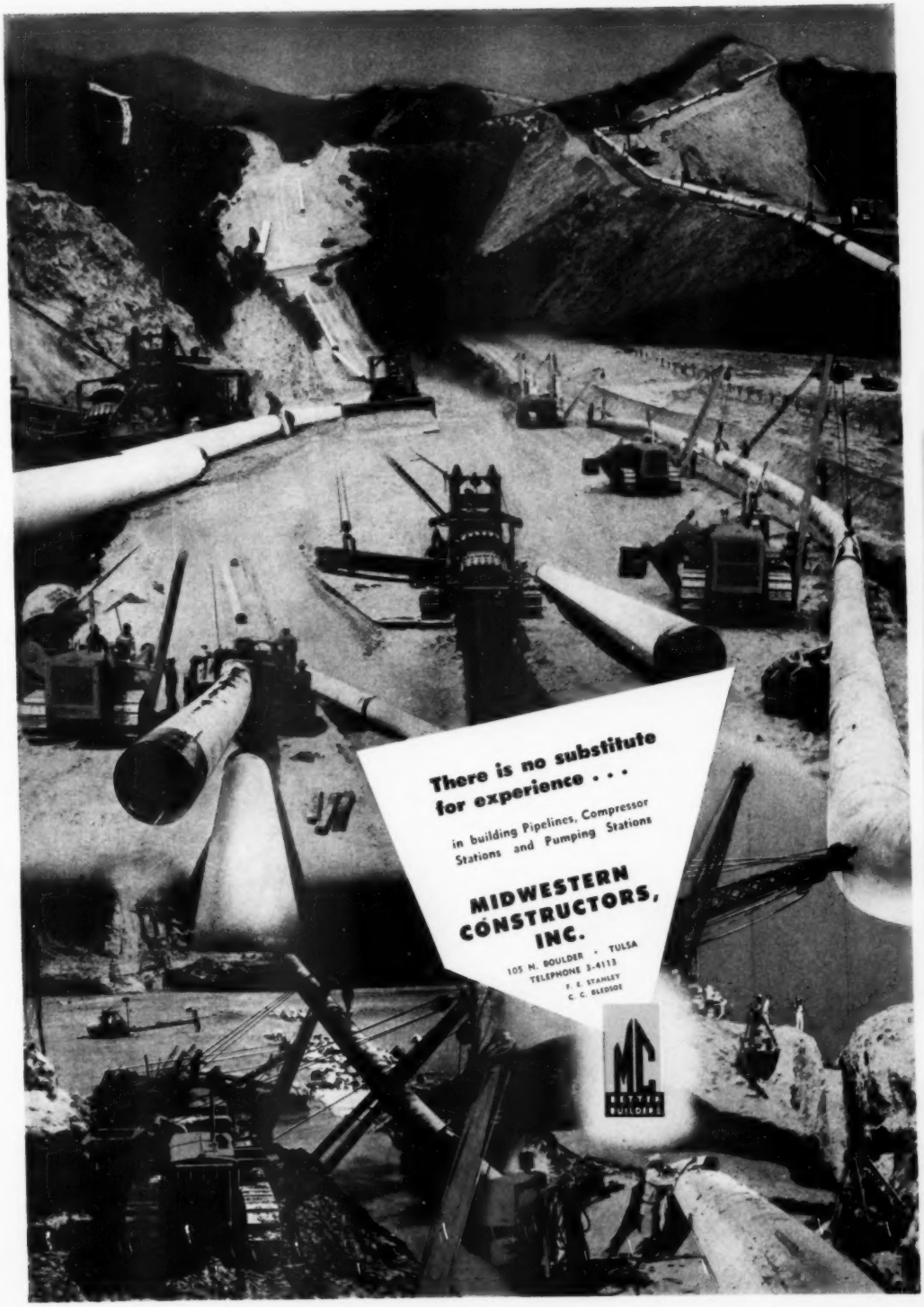
After the pools had been discovered in the Bartlesville area, the company decided to extend its system to that point. Actual construction was delayed because it was discovered that the company could not build into what was then Indian Territory, except through approval of Congress. The line to Bartlesville was completed in December 1904 and it became the first trunk line in what is now Oklahoma.

The Prairie company quickly connected to Red Fork and Glenn pools near Tulsa with a 134-mile, 6-in. line, after Glenn pool was discovered in 1906. The first major pipe-line construction to the north took place in 1904 when the Prairie company built a 113-mile, 8-in. line from Humboldt to the new Sugar Creek (Kansas City), Mo., refinery of Standard Oil Co. (Indiana).

Sinclair Growth

The pipe-line chronology of the Sinclair companies is one of the most interesting of the Southwest, reflecting changing economic conditions in which pipe-line transportation was often dominant in determining trends affecting

Typical station on the Glenn pool, Indian Territory-Port Arthur, Tex., refinery of The Texas Co. pipe line under construction in 1907. The principal equipment consisted of four 175-hp. boilers and three steam pumps.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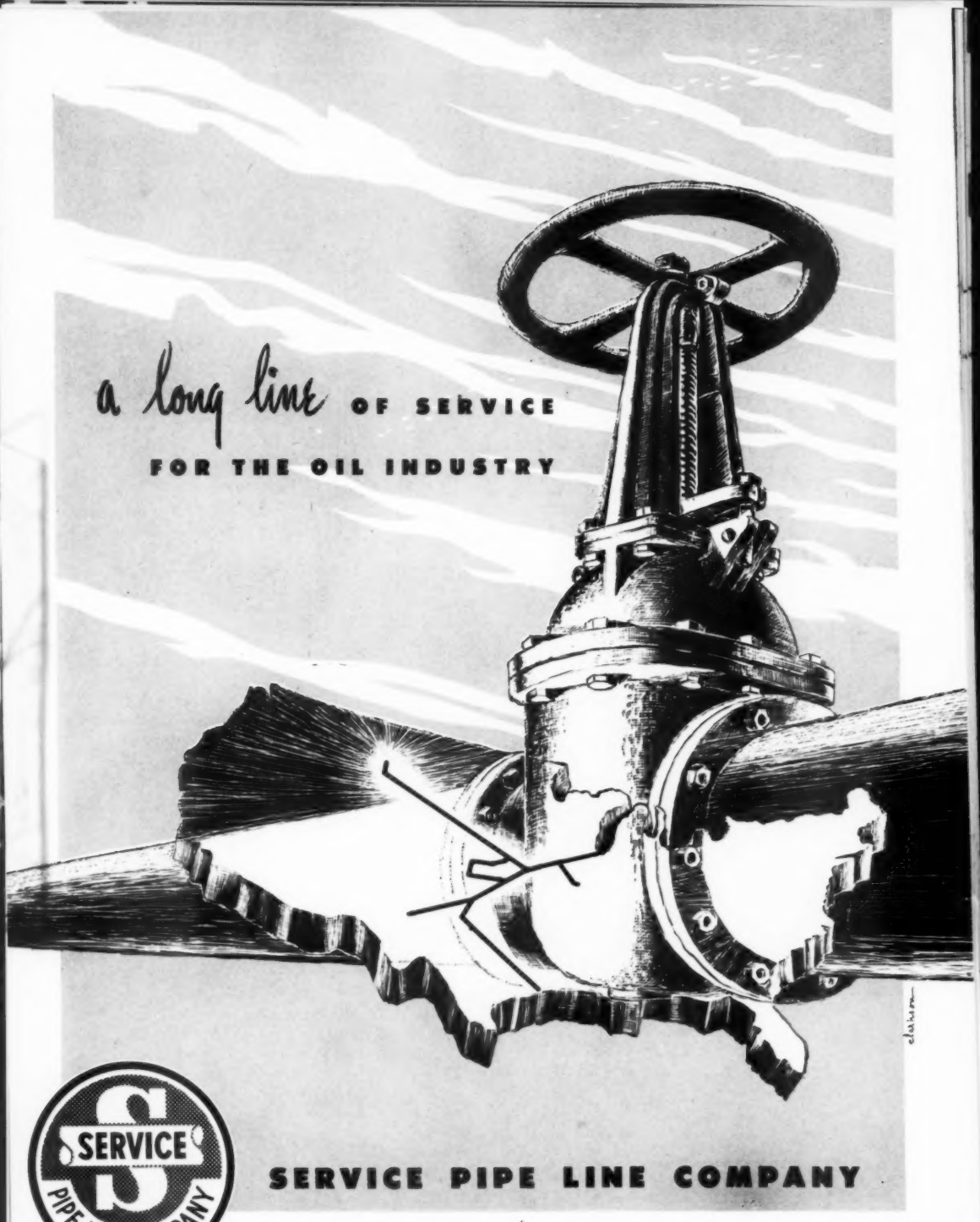
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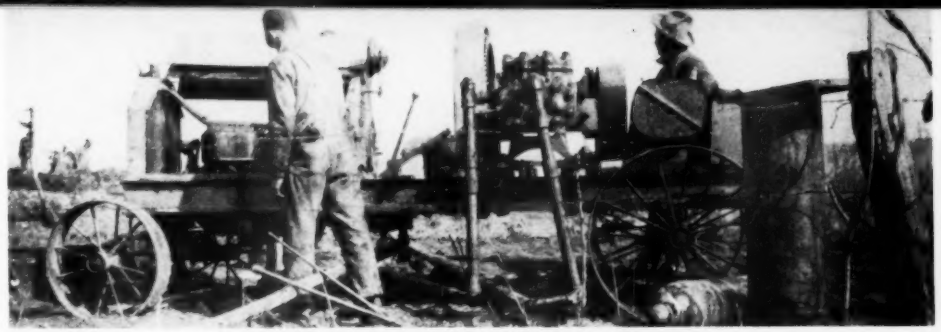


Early-day pumping equipment in temporary service mounted on a manure spreader in service for Sinclair Pipe Line Co.

the operations of the entire company. The company—known originally as Sinclair Oil & Refining Co.—was a consolidation of six companies headed by H. F. Sinclair who entered the oil business a few years earlier as an independent producer in Kansas. Previously he had been a druggist in Independence, Kans. Recently retired, he directed the company's activities until it became not only one of the largest concerns of the Southwest but a major national operator with important foreign holdings.

When organized, the company had five refineries located at Cushing, Muskogee, and Vinita, Okla., and Chanute and Coffeyville, Kans., all served with small pipe-line systems. All these plants have since been dismantled although the Coffeyville plant was operated until 1949.

The company quickly recognized the desirability of building large plants in consuming and shipping centers and starting in 1917 the company laid plans to build lines to the Chicago area and to the Gulf Coast. Plants which are now major refineries of the oil industry were built at East Chicago, Ind., and Houston.

In 1921 a half interest in Sinclair Pipe Line Co. and Sinclair Crude Oil Purchasing Co. was sold to Standard Oil Co. (Indiana) for $17,000,000. The system was expanded at several points and in 1930 Standard Oil Co. (Indiana) purchased the remaining half of the two companies for $72,500,000.

The Sinclair company largely replaced this transportation facility when it acquired through merger the properties of Prairie Oil & Gas Co. and Prairie Pipe Line Co. The Prairie pipe-line system, whose early activities were explained previously, over a period of years was adapted to the expanding operations of the Sinclair company.

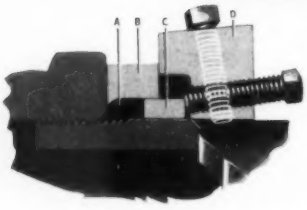
An interesting development of the postwar period was the extension of the Sinclair product pipe-line system from the Houston refinery north to Kansas City where it joins another product line to East Chicago and from there east to a system which connects to many middle-west consuming centers and then on to another major Sinclair refinery at Marcus Hook, Pa. Last year the company acquired the refinery of Wood River Oil & Refining Co. in East St. Louis, Ill., area and its product lines are now a part of this transcontinental products system. Within the Southwest this has resulted in the shutting down of the Sinclair refineries at Sand Springs, Okla., Fort Worth, Coffeyville, and Kansas City.

Interstate History

The present Interstate Oil Pipe Line Co., with general headquarters in Shreveport, one of the largest systems serving the Southwest, has a representative history that goes back to 1909. Its growth over the 42-year period reflects the changing conditions in southwest development which has brought progressive changes in the activities of companies which now are all included in the Interstate system, subsidiary of Standard Oil Co. (N.J.).

The present southern division of Interstate until 1944 was the pipe-line division of Standard Oil Co. of Louisiana and the present northern division was the Oklahoma Pipe Line Co. The main function of the Standard of Louisiana division was to gather and transport crude to the Baton Rouge refinery of the parent company. Over a period of years it extended its

One of the first Wiggins floating roofs used in Cushing, Oklahoma, field in 1923. Pontoon-type decks were developed in 1928.



(A) Gasket.
(B) Gasket Container Ring.
(C) Sliding Push Ring.
(D) Main Ring.

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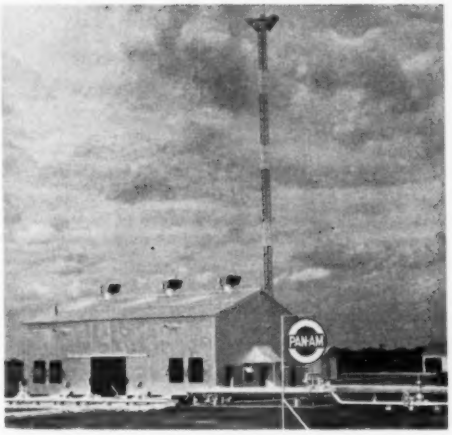


The pipe line industry is one of the largest users of all the principal types of communication. This shows a 140-ft. microwave tower at the Colorado City, Tex., station of Pan American Pipe Line Co.

system to connect to most of the principal fields in North Louisiana, Mississippi, Arkansas, and later to the Gulf Coast area of Louisiana.

Oklahoma Pipe Line Co. was organized to gather and transport crude south in Oklahoma and Kansas to the Baton Rouge refinery. A three-segment operation was perfected in 1910. Oklahoma Pipe Line Co. gathered and transported crude to the Arkansas-Oklahoma line where it was picked up by the pipe-line division of Prairie Oil & Gas Co. This company transported it across Arkansas and delivered it to the pipe-line system of Standard Oil Co. of Louisiana.

Late in the 20's it became apparent that the company would need a northern outlet, and Standard Oil Co. (N.J.) built the line under the name of Ajax Pipe Line Co. from the Glenn pool area to Wood River, Ill. This was a double 10-in. line. Later, stock interest in this company was acquired by the Sohio company, Pure Oil Co., Carter Oil Co., Imperial Oil, Ltd., and Standard Oil Co. of New Jersey (Delaware).

Hazards

Indicative of the hazards of major pipe-line operation in the late 30's the need for the two Ajax lines dimished because of the revival of major operations in south Illinois. Within a short time the throughput dropped to a low of 3,625 bbl. daily. There was a quick change in this situation, however, as World War II approached and by 1945 the two lines were operating at capacity. During this war period the southbound movement of the Oklahoma-Standard of Louisiana facilities was in part reversed and crude oil was brought north into Oklahoma and tendered to the lines which had an eastern destination.

Oklahoma Pipe Line was among the first to adopt aerial pipe-line patrol. This method of patrol did not quickly replace the "pipe-line walker" who through the years had become one of the most widely known personalities of the oil industry. On May 5, 1935, a pressure drop on the Glenn pool-Arkansas trunk line indicated a leak between the Red Oak and Kinta stations. Due to the rugged country the management decided to search for the leak from the air. Within 2 hours the pilot had located the leak and had dropped a message to the Kinta station. It was estimated that it would have required a land party 10 to 12 hours to have completed the search.

The original Standard of Louisiana 268-mile line had four stations. Each was equipped with three 100-hp. diesel engines, three 6 by 18-in. vertical pumps, and two 37,500-bbl. steel storage tanks. Each station had three dwellings for employes. This was a typical station operation of that period.

It soon became apparent that the 10,000-bbl. capacity of this line would not be sufficient. Near the close of 1909 a wildcat discovery opened Caddo field and it quickly became one

Laying first "big inch" natural-gas pipe line from Petrolia field of North Texas to Fort Worth in 1909.

This tank farm operated by Stanolind Oil Purchasing Co. is one of the largest in the world. The storage represented by the 55,000 and 85,000-bbl. tanks totals 5,000,000 bbl. of crude oil.

of the major supplies of the Southwest. The Standard of Louisiana line was connected to the field in 1910 and deliveries of the high-gravity crude to the Baton Rouge refinery started. Other fields were discovered in the same area, loops were installed on the line, and by 1913 the capacity of the system was increased to 30,000 bbl. daily.

A chronological history of what became the Interstate pipe-line system in 1944 shows frequent changes in the system from year to year. Extensions were made to new fields within the area served by the company, and trunk-line connections were often made with other systems in order to facilitate the over-all movement of crude oil within the Southwest and to areas as far east as the Atlantic seaboard.

In 1923 Standard Oil Co. of Louisiana purchased the Prairie pipe line in Arkansas and it was incorporated in the present Interstate system.

Operating Innovations

Interstate is credited with many innovations in construction and operation. The company reports show that in 1933 it adopted the use of electric spot welding in repairing pipe. This permitted repairs to be made on a pipe line while it remained in service and replaced the old method of applying temporary patches. That year the company purchased 10 gasoline-powered welding machines and repaired approximately 200,000 ft. of pipe.

In 1946 Interstate started using radio-telephone for pipe-line communications. A fixed-location transmitting and receiving station was erected at Wilson, Okla., with remote-control units located at the Wilson depot office and at the Hewitt, Okla., station. This was connected with five mobile units installed in company vehicles. The same year the company started the use of a transport plane and also made a contract with an outside firm covering pipe-line patrol service by air.

After World War II the company, in cooperation with Aluminum Co. of America, carried on experimental work in the use of aluminum line pipe. The pipe was used in the Magnolia, Arkansas, field in the handling of sour crude.

Largest Line

Humble Pipe Line Co., a 100 per cent owned subsidiary of Humble Oil & Refining Co., within a period of 30 years has become the largest transporter of crude oil within the Southwest. Its activities are confined to the states of Texas and Louisiana.

In 1919 Humble's pipe-line operations consisted of 50 miles of pipe line, all 4-in. or less. The system has been rapidly expanded so that it now exceeds 9,000 miles of gathering and trunk lines.

A 1950 report showed that the company was transporting 571,000 bbl. daily of petroleum consisting of 545,000 bbl. of crude oil, 12,000 bbl. of natural gasoline, and 14,000 bbl. daily of refinery products. It was connected to 290 fields and 21,297 wells located on 4,545 leases. The company has pioneered in several of the major developments in the design and operating of both gathering and trunk line operations. Particular attention has been given as to methods used in batching many grades of crude oil from the fields to refineries and shipping terminals without contamination. Recently the company was shipping 55 grades of crude oil and 4 special grades of mixtures. To do this it

Jim Cummings of Crutcher-Rolfs-Cummings, Inc., Houston, demonstrates original side boom and winch model developed by him before the firm was organized in 1933. The firm has originated other important pipe-line-construction equipment.

is often necessary to have several grades of crude oil in a particular line at one time.

Practices

The rapid expansion in gathering and trunk-line systems in the Southwest following World War I caused operators to give more attention to the possibilities of reducing installation and operating costs by new methods and equipment. There were many innovations during that period.

Possibly the most noteworthy of these was the use of acetylene and electric welding. Prairie Pipe Line Co. and Noah E. Wagner of that company are credited with the introduction of acetylene welding for all oil pipe-line work. In 1920 the company welded 15 miles of 8-in. using pipe of 17 to 24 ft. instead of the usual 40 ft. Before being placed in service, the line was tested at 800-lb. pressure and a scraper was run through the line. Observers were fearful that the "icicles" which were part of the welding operation would retard the movement of the scraper and the crude. The tests showed that they obtained the same operating results as with the screwed-coupling lines then in use.

The Prairie company decided to weld the 140-mile, 8-in. line from Mexia and Hensley, Tex., and this was the first long-distance application of the method. Over the next few years there were a number of applications of acetylene welding in pipe-line construction.

In 1929 electric welding came into extensive use for welding together the bell and spigot joints of pipe. Electric welding for butt joints without backup ring came into extensive use starting in 1932. Electric welding had been used in the repairing of lines starting in 1928.

The use of the centrifugal pump in booster stations started in 1926 in Seminole field. It proved successful in this application and soon installations were made at the main-line pumping stations. The centrifugal pumps were usually operated with electric motors, and this brought the first applications of automatic operation not possible on a comparable basis when steam, oil, or gas engines were used for power.

Starting in the late twenties pipe-line companies began to use aerial photography in connection with their survey work in the installation of pipe lines in new areas. There were also many improvements in the design of diesel and gas engines, both for permanent installations and semiportable.

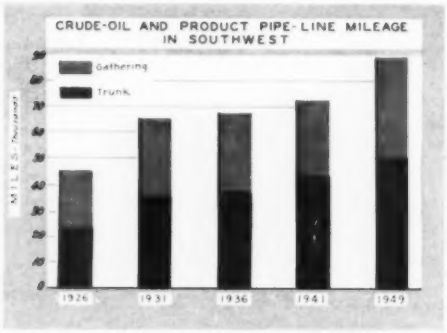
Another development was seamless pipe for trunk-line service starting in 1928. A competitor of pipe made with electric-welded seams was soon introduced. Both types of pipe were quickly adopted by the pipe-line industry. The higher-tensile-strength pipe with thinner walls brought important savings in reduced freight charges, stringing and laying costs, lower investment, and greater inside diameters which added to the capacity of the line.

Large-Diameter Line

Starting in the thirties there was a trend toward the use of large-diameter pipe. Previously operators had been able to expand the capacity of their systems by increasing pressures with their 4, 6, 8, and 10-in. lines, a development partially accounted for by improvements in pumping design. The early practice was to install loops in existing systems whenever necessary.

It was noteworthy that starting in the thirties new systems did not use any pipe under 10-in., with more and more 12-in. being laid. Later 14 and 16-in. lines were used although generally on short movements.

Before the entry of this country into World



War II engineers were convinced that crude oil lines using 18 to 24-in. pipe were entirely feasible provided there was a sufficient volume of oil to be transported. The application came quickly when it was decided to build a 24-in. war-emergency line from East Texas to the Atlantic seaboard. This was followed by a 20-in. products line connecting to Texas and Louisiana refineries and also extending to the Atlantic seaboard. The crude line became a necessity when in 1942 it was apparent that coastwise tanker distribution was vulnerable to the action of the enemies' submarines. Both the big-inch crude-oil and products-line operation proved practical in every way, and toward the close of the war period the 24-in. crude line transported approximately 300,000 bbl. daily and the 20-in. products line in excess of 200,000 bbl. daily.

While these two war lines have been converted to natural-gas transportation, they served to emphasize the possibility of big-inch lines in the movement of crude oil and important applications have been made in the Southwest in interstate operations over the past 5 years. There are important savings over the small-inch operations in both construction and operating costs. In addition to the entirely new lines ranging from 16 to 22-in.. some of the larger pipe-line companies are replacing their small-inch operations with one or more big-inch lines. This development has brought major changes in the design of power and pumping equipment which are outlined later.

While most of this transportation has always taken place in the major systems, as has been described, there is still an important movement by smaller lines including those which serve independent refineries from nearby fields. Originally the large systems seldom served the independent refineries located in the Southwest. This situation has changed in recent years and now a number of small refineries receive part or all of their crude-oil supply from the larger systems.

A decision of the United States Supreme Court rendered June 22, 1914, in what was known as "The Pipe Line Cases" held all pipe lines engaged in the interstate transporation of oil were common carriers and subject to the regulations of the Interstate Commerce Commission as such. The decision was in accordance with the Hepburn Act relating to common carriers passed June 29, 1906.

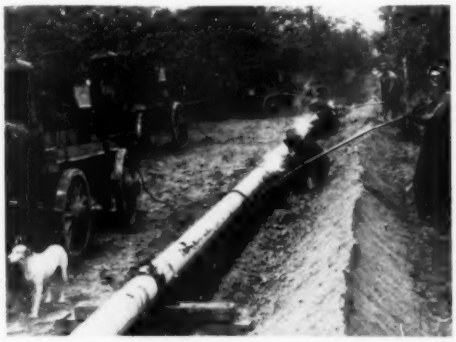
Prior to the decision Prairie Oil & Gas Co. had refused to act as a common carrier. After the decision, Prairie Pipe Line Co. was formed to carry on transportation activities with Prairie Oil & Gas Co. acting as a producing, purchasing, and storage company. Oklahoma early in its oil history enacted a common-carrier act on intrastate shipments and other states approved similar legislation as their pipe-line movement of crude oil became an important factor in operations.

The evolution from the "tong" or "pipe hook" and screwed-coupling method of laying pipe line in hand-dug trenches has been steady over the past 30 years. The laying of the lines has become largely a machine operation. Because of improved methods lines are now often economically laid in areas not accessible for pipe-line operation 20 or more years ago.

It is also a long way from the 175-hp. steam boilers connected to steam pumps of the 1901-1910 period to the 1,600-hp. diesel engines or purchased-power installations of the past decade. In the case of the natural-gas compressor units, ratings are as high as 2,500 hp.

Historical Growth

Yearly since Spindletop there have been important extensions to pipe-line transportation



Crew on the firing line of the first major electric-welded pipe line consisting of 169-mile, 8-in. pipe line from San Augustine to Corsicana, Tex. This line was welded by H. C. Price Co. for Texas Pipe Line Co. in 1928.

Another
MISSION ACCOMPLISHED
Last year it was a fresh gas supply for Buffalo . . . 1951 will see a new line to Chicago and the first line to New England . . . In 30 years over 20,000 miles of pipeline completed on schedule . . . under all conditions . . . through some of the toughest terrain in the world.
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Carrying

NATURAL GAS *to* 18 MILLION PEOPLE

Natural gas has reached the country's greatest population center—the northeastern seaboard area—through the Transcontinental pipe line that started on its way less than two years ago.

To get there, the pipe line had to go over—under—or through scores of natural obstacles . . . rivers, mountains and swamps. It had to bypass congested metropolitan areas and cross a network of 160 railroads . . . 355 highways . . . 40 rivers. More than 500,000 tons of steel were fabricated into its 1,840 miles of pipe.

Major public utilities in the New York-New Jersey-Philadelphia area, together with many in southern states along the route of the pipe line, are being supplied by Transcontinental so that an estimated 18 million individuals can enjoy the benefits of natural gas. These utilities can plan ahead with confidence, for growing natural gas reserves along the Gulf Coast are presently estimated in excess of 60 trillion cubic feet—enough for Transcontinental to fulfill its commitments to present customers for generations.

Transcontinental gas pipe line—world's longest—stretches 1,840 miles from Texas to New York

TRANSCONTINENTAL GAS PIPE LINE CORPORATION

TRANSCONTINENTAL GAS PIPE LINE CORPORATION

HOUSTON · TEXAS

in the Southwest. Starting with small local systems supplying refineries at Corsicana, Tex., and Neodesha, Kans., pipe lines now have the responsibility of transporting approximately 4,370,000 bbl. daily of crude oil and condensate in the Southwest (Oklahoma, Kansas, Texas, Louisiana, Mississippi, Arkansas, and New Mexico). In addition a large part of the production of natural gasoline and cycling plants in the Southwest totaling approximately 400,000 bbl. daily is transported for short distances by pipe line.

In 1926, according to the Bureau of Mines, a report showed that trunk-line mileage for crude oil and products in the Southwest totaled 22,910 miles and gathering systems 21,920 miles. By January 1, 1950, this has increased to 50,110 miles for the trunk lines and 40,015 miles for the gathering lines.

The size of the pipe lines is of interest. The trunk-line system in the Southwest on January 1, 1950, consisted of 497 miles of less than 4-in.; 1,790 miles of 4-in.; 6,659 miles of 6-in.; 17,694 miles of 8-in.; 8,506 miles of 10-in.; 4,827 miles of 12-in., and 3,035 miles of over 12-in. The gathering lines ranged from 2 to 10-in. About half were 4-in.

Modern Methods

Paul Reed, pipe-line editor of The Oil and Gas Journal, at this point outlines briefly some of the changes that have taken place in pipeline practices in recent years.

Pipe-laying methods are essentially similar for crude oil, products, and natural-gas pipe lines. In the last 30 years procedures have been changed by the introduction of machinery supplanting work done by large crews of men working with teams of mules and horses and a variety of hand equipment including pipe tongs, jack posts, winches, mope poles, and mormon boards.

Clearing of right-of-way formerly done by ax gangs and teams is now accomplished largely by power saws and bulldozers. Pipe is strung along the right-of-way by pipe trucks which haul from an unloading point on the railroad.

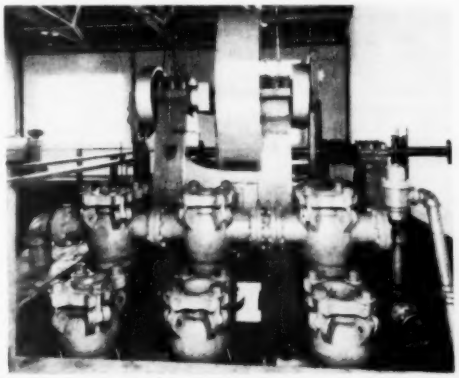
Formerly ditching machines competed with hand labor; now all pipe-line ditches are dug by ditchers, drag lines, or back hoes, except in exceptional situations. Small-diameter pipe is now widely bent by shoes mounted at the base of tractor A-frames. Large-diameter pipe is now bent by engine-operated machines capable of making smooth bends.

The older methods of connecting joints by screw-and-threaded couplings and (in many cases on natural-gas lines) by bolted couplings have been superseded by electric welding. There was a transitional period in which there was much oxyacetylene welding. A stringer bead is run when the pipe is lined up; this may be followed by a "hot pass" to give additional strength prior to running filler and then stringer beads run by welders working behind the front-end lineup operations.

Formerly pipe was laid bare in the ground. Coatings were applied by hand "ragging"; felt was spirally wrapped by hand-rotated devices. A significant advance in pipe protection came with the development of a machine which combined hot application of coating and immediate spiral wrapping.

In practice there are two steps in pipe protection. (1) An engine-driven machine, which both cleans the pipe and applies a priming coat, follows behind welding and ahead of (2) the "dope" or coating-and-wrapping machine which applies hot coating. This coating is usually wrapped with a glass mat which meshes in the hot coating or with asbestos felt which bonds to the hot coating. On some projects both glass and felt wrapping may be applied simultaneously by the dope machine. Electronic holiday detectors are commonly run behind "dope" operations to locate flaws in the coating, so they may be patched immediately. Much coating and wrapping of pipe is done at yards prior to shipping to the line.

Where a line traverses rocky ground "padding" with soft dirt is usually specified to prevent damage during backfilling. An alternative for such padding has been recently introduced; this consists of wrapping the pipe with a hard, pliable "rock board."



This early-type Goulds vertical pipe-line pump was used by Galena Pipe Line Co. in Houston area. Later horizontal reciprocating pumps were generally used and more recently, centrifugal pumps were introduced.

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FOR ALL PRESSURES!
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With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

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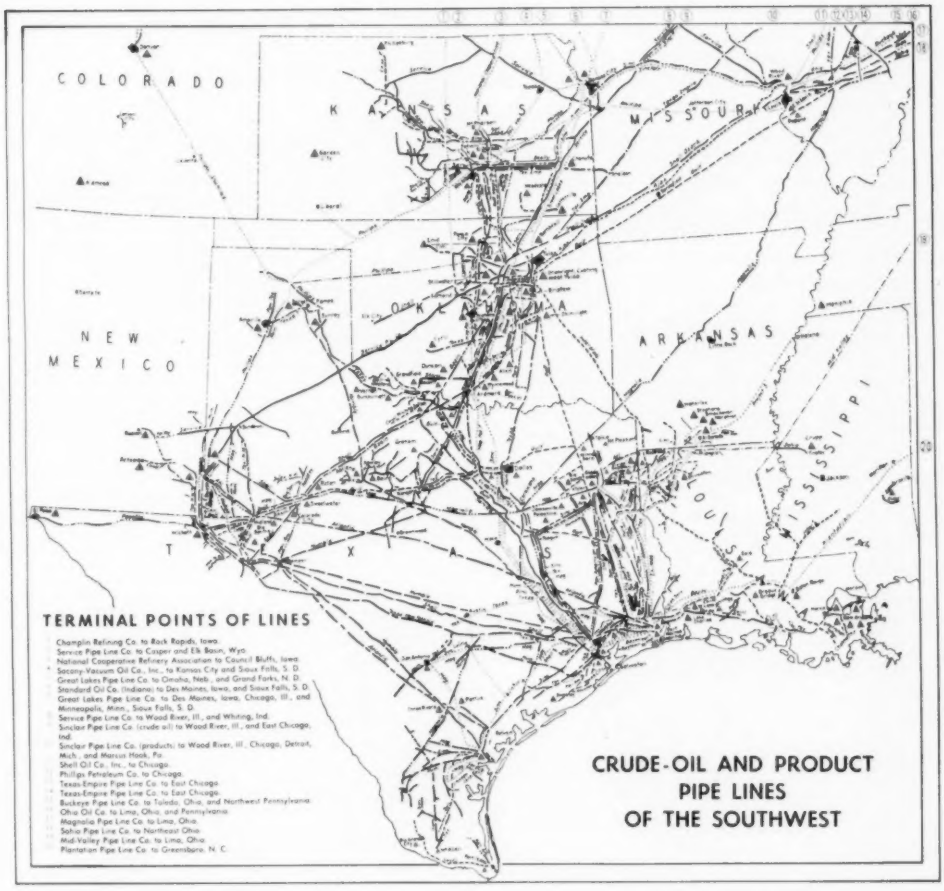
LUG NUT UNIONS
Hammer-type for quick opening and quick closing.


COLORADO
KANSAS
MISSOURI
NEW MEXICO
OKLAHOMA
ARKANSAS
MISSISSIPPI
TEXAS
LOUISIANA
TERMINAL POINTS OF LINES
Champlin Refining Co. to Rock Rapids, Iowa.
Service Pipe Line Co. to Casper and Elk Basin, Wyo.
National Cooperative Refinery Association to Council Bluffs, Iowa.
Socony-Vacuum Oil Co., Inc., to Kansas City and Sioux Falls, S. D.
Great Lakes Pipe Line Co. to Omaha, Neb., and Grand Forks, N. D.
Standard Oil Co. (Indiana) to Des Moines, Iowa, and Sioux Falls, S. D.
Great Lakes Pipe Line Co. to Des Moines, Iowa, Chicago, Ill., and Minneapolis, Minn., Sioux Falls, S. D.
Service Pipe Line Co. to Wood River, Ill., and Whiting, Ind.
Sinclair Pipe Line Co. (crude oil) to Wood River, Ill., and East Chicago, Ind.
Sinclair Pipe Line Co. (products) to Wood River, Ill., Chicago, Detroit, Mich., and Marcus Hook, Pa.
Shell Oil Co., Inc., to Chicago.
Phillips Petroleum Co. to Chicago.
Texas-Empire Pipe Line Co. to East Chicago.
Texas-Empire Pipe Line Co. to East Chicago.
Buckeye Pipe Line Co. to Toledo, Ohio, and Northwest Pennsylvania.
Ohio Oil Co. to Lima, Ohio, and Pennsylvania.
Magnolia Pipe Line Co. to Lima, Ohio.
Sohio Pipe Line Co. to Northeast Ohio.
Mid-Valley Pipe Line Co. to Lima, Ohio.
Plantation Pipe Line Co. to Greensboro, N. C.
CRUDE-OIL AND PRODUCT PIPE LINES OF THE SOUTHWEST

Skids support the pipe line during welding and until it is picked up by tractor-supported cradles for the cleaning-machine and dope-machine operations. After doping, the line may be lowered again to the skids or it may be lowered directly into the ditch by the "cradling into the ditch" method.

The first method of lowering pipe to the skids gives a convenient opportunity for finding and patching flaws. However, unless special provisions are made, the coating may be damaged where it is in contact with the skids. It has been a common practice to complete lowering-in operations in the early morning hours when the pipe is cool and contracted.

Backfilling, usually by bulldozers but sometimes by backfillers, follows lowering in to return the "spoil bank" of excavated earth or "backfill" to the ditch to cover the pipe. When the second method, known as cradling into the ditch, is used, backfilling often proceeds within sight of the doping operations.

In recent years some companies are departing from the customary practice of having slack in the pipe when it is placed in the ditch. More attention is now being given to clearing up the right-of-way behind construction operations so that it may be in good shape for the land owners.

Pump stations for crude-oil lines were generally converted more than 30 years ago from steam to diesel power for driving slow-speed reciprocating pumps. Within the past 20 years there has been a marked increase in installation of centrifugal pumps driven by diesel engines and, to a growing extent, by electric motors. Nearly all products-line pumps are centrifugal. New types of reciprocating pumps have been introduced in product and crude-oil lines in the last 10 years including those of high-

speed multicylinder, and variable-stroke types.

Compressor stations for natural-gas lines have been largely equipped with reciprocating slow-speed gas-engine-driven units. In the last 16 years there have been a great many of vertical and angle-type high-speed compressor units. The postwar period has seen a widespread return to installation of the horizontal type; however, this is not regarded as a trend. Within the last 4 years centrifugal compressors have been developed. One company used these extensively with electric motor drive; this year another company is commencing operation of three steam-turbine-driven centrifugal compressor stations; and a third company is planning for early construction of six stations with internal-combustion turbines for driving centrifugal compressors. Additional information on natural-gas pipe lines is presented in the Natural-Gas Section of this issue.

Controls

Remote and automatic controls are becoming practicable for diesel as well as electric-motor-operated pumps on crude-oil and products lines. It is predicted that they will be applied to gas compressor stations, particularly where gas turbines will be operated.

Microwave communication facilities are being installed on many new pipe lines. These will enable the central office to converse with stations and even, by relay over high-frequency radio, with company cars and trucks in the vicinity of the line. By such microwave systems, dispatchers could obtain direct readings of instruments and could start and stop units and operate valves at remote stations.

The advantages of large-diameter pipe have been exploited extensively for petroleum and natural-gas lines in the postwar period. Many

One or more ancient cannon, usually of Civil War vintage, for many years were an essential part of tank-farm equipment. They were used in making holes in a tank of oil when it caught fire, letting the oil flow into the surrounding dyke before it boiled over from the heat or exploded and caused more serious damage to the immediate area.

Portable Gaso-type pumping unit used in the operation of field gathering systems.

installations of big-inch crude-oil and natural-gas lines have been made in the Southwest since the close of World War II.

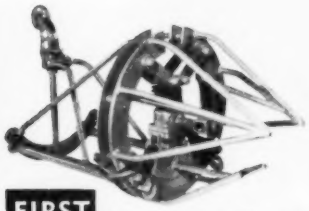
The development of gas-tight tankage for a variety of uses has been one of the important developments in crude-oil and product transmission and all related operations, having a direct bearing on conservation accomplishments. For years evaporation losses were heavy in the handling of crude oil from the wells through the gathering and trunk-line operations to refinery and terminal storage. Early tests showed losses as high as 5 per cent in the case of high-gravity crude oils.

One of the outstanding developments in the early twenties was the Wiggins floating roof. This design served the dual purpose of providing gastight storage and at the same time the floating-roof feature provided flexibility in capacity desirable in the use of working storage. Fire and other hazards incident to evaporation losses were reduced.

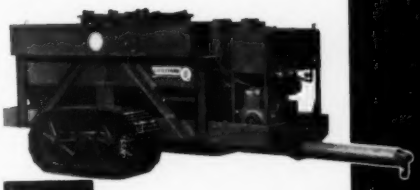
The inventor was John H. Wiggins, who previous to the development of the floating roof, had been connected with the Bureau of Mines as an engineer. In 1923 Wiggins entered into an agreement with Chicago Bridge & Iron Co. covering the sale and installation of the tankage. Hundreds of tanks were installed in the Southwest and other areas.

In 1945 the contract with the Chicago Bridge company was not renewed and was taken over by General American Transportation Co. These two companies, Graver Tank & Manufacturing Co., Inc., and other concerns through the years have designed gastight tankage covering every use in the oil and gas industry from lease storage to that used in the operation of crude-oil and products lines.

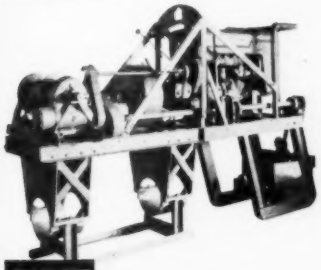
CROSE contributions to the continued development of pipe line construction equipment



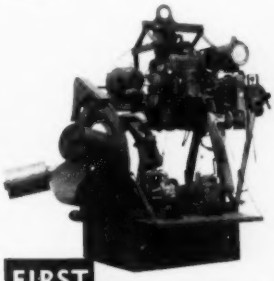
FIRST Internal Lineup Clamp to make possible the rapid welding of large diameter pipe line



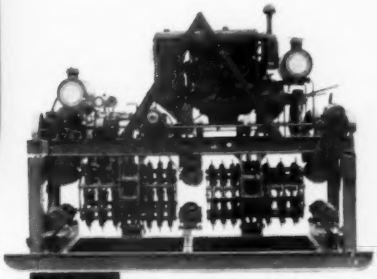
FIRST Hydraulically agitated, low pressure burner-type Pipe Line Coating Kettle



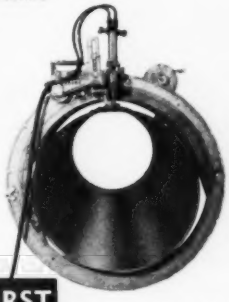
FIRST Practical Road Boring Machines



FIRST Spray-type Pipe Coating and Wrapping Machine that also coats the bends



FIRST Double-head Cleaning and Priming Machine for speedy reconditioning of old pipe



FIRST Aluminum Alloy Pipe Cutting and Beveling Machine with 360 traveling ring and out-of-round attachment

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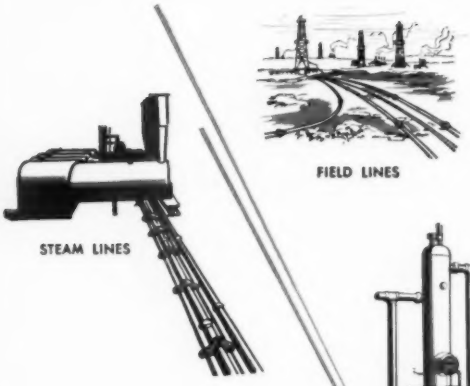
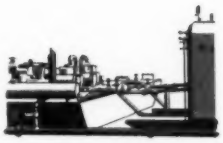


FIELD LINES

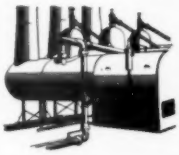


WATER LINES

STEAM LINES

SEPARATORS

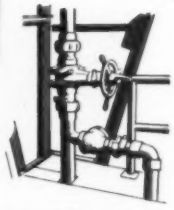
TANK BATTERIES



BOILER HEADERS

SLUSH PUMP STRAINERS

XMAS TREES



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. . . the perfect coupling for drilling and production service

There is no limit to the uses for UNIBOLT Couplings in drilling and production service. Any line — steam lines, water lines, mud lines, oil and gas lines — can be coupled tighter, with a stronger joint, and dismantled and reassembled in fast time with UNIBOLT Couplings. Three types of seats: a metal ring gasket type for high pressure service, a renewable resilient type for saturated steam and low pressure oil, gas, or water lines, and a tongue and groove type which conforms to ASA-600 Series specifications for welding neck couplings. Hubs are provisioned for threaded, socket weld, or butt weld connections. The pressure range is up to 15,000 lbs. test.

So, you name the coupling job and UNIBOLT will furnish the coupling designed expressly for that job. Make the most of a good thing . . . UNIBOLT.

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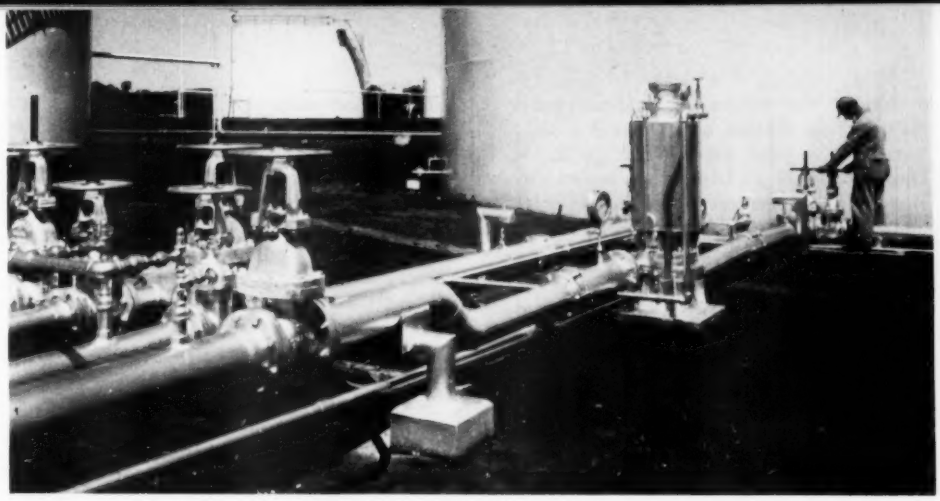


Product tanks at the terminals of Great Lakes Pipe Line Co. have individual incoming and outgoing lines and a pump which makes each tank on the farm a separate entity. The tank can be used for receiving, can be closed off and its products blended, and then the refinery products pumped to the loading facilities.

Products Pipe Line a 20-Year Development

THE decade starting in 1930 brought the first important applications of product transportation by pipe line. Previously a crude-oil line in the East had been converted to products service, and within the Southwest and in other areas there were short lines of small diameter usually transporting natural gasoline from a field plant to a loading terminal.

Starting in the late twenties, refinery operators in the Mid-Continent began to give serious consideration to the possibilities of long-distance transportation of gasoline to northern points. These refiners were finding it increasingly difficult to ship their products by tank car and compete with refineries located in the Middle West which obtained their crude-oil supplies by pipe line. There were many skeptics as to the feasibility of gasoline transportation but in 1930 two major projects were under way.

Continental Oil Co., Mid-Continent Petroleum Corp., Pure Oil Co., Phillips Petroleum Co., and Skelly Oil Co. organized the Great Lakes Pipe Line Co. and started the construction of a 6 and 8-in. system extending from Oklahoma and Kansas refineries to Des Moines, Chicago, and Minneapolis by way of Kansas City. The cooperative project was successful from the start and has since been greatly expanded so it now has a capacity of nearly 200,000 bbl.

Several changes have been made in the

Original 1930 installation at Paola, Kans., pumping station of Great Lakes Pipe Line Co. Later this manifold arrangement was replaced by an aboveground system of direct switching which eliminated the numerous valves, stubs, and crossovers. The cooling tower at the left was replaced by an underground heat exchanger connected to an incoming line.

ownership. The system is now connected to 14 refineries in Kansas and Oklahoma and deliveries have been extended as far north as Grand Forks, N. D. Last year a report showed that the line was connected to 14 terminals and the company was making deliveries, with the cooperation of tank trucks and tank cars, to 2,400 destination points.

The original line delivered only one grade of gasoline. The system now handles several grades of products including not only gasolines, but distillates and kerosine.

Phillips Line

Starting at about the same time, Phillips Petroleum Co. organized Phillips Pipe Line Co. and built a products line to East St. Louis, Ill., from its Borger, Tex., refinery. It was later extended to Chicago. It was also connected to the Great Lakes line, permitting an exchange of products and widening the delivery territory for both systems. This single privately owned line was also successful from the start and indicated the possibilities of moving the principal refined products by pipe line over long distances.

Since that time there has been a steady expansion of product pipe lines within the Southwest and also the building of lines north, east, and west from the Southwest.

Within a few years most of the larger consuming centers in the Southwest were connected to one or more product lines. In some instances these lines are described as "extended loading racks" of the refineries. These lines are used exclusively in the transportation of the products of one refinery. Other lines transport the products of two or more refineries, and in some cases they are jointly owned and operated. Destination points for products lines originating in the Southwest include Pueblo, Denver, and several cities in the Middle West and the Southwest. Market students are in agreement that these lines have made possible the continuance of an important refining industry within the Southwest. Previously it was feared that refining in the Southwest would be confined to a few plants supplying local requirements and the coastal plants which have access by water to Atlantic seaboard and foreign markets.

While the original products lines largely duplicated the crude-oil lines in equipment and method of operation, it was early found that the transportation of products presented special problems and also that important savings were possible in both construction and operation by designing equipment adapted to the movement of plant products.

6,818 Miles of Products Lines

A year ago the product mileage in the Southwest totaled 6,818 miles out of a total for the entire country of 20,881 miles. No separate data are available as to the movement of products in the Southwest but it is estimated that it now accounts for more than 50 per cent of the national total of approximately 1,200,000 bbl. daily. This includes lines which originate in the Southwest but whose points of destination are outside that area.

Of the total for the Southwest the distribution by states is as follows: Arkansas, 254 miles; Kansas, 2,092 miles; Louisiana, 544 miles; Mississippi, 166 miles; Oklahoma, 1,137 miles; and Texas, 2,625 miles. All of the pipe is 12-in. or less with greatest mileage of 9,979 miles of 8-in.

Terminal of Shell Pipe Line Corp., Deer Park, Tex., where products are received by pipe line from the cycling and natural-gasoline plant located in the Sheridan, Texas field. The line consists of 100 miles of 6-in. pipe.

PIPE LINES PROMOTE PROGRESS

From its producing subsidiary, Union Producing Company, and from hundreds of other gas producers in the Gulf South, United purchases annually a great and growing supply of natural gas.

Last year, for example, United Gas and Union Producing Company paid over 30 million dollars to producers, royalty-owners and land-owners for gas purchased or produced in Texas, Louisiana, Mississippi and Oklahoma.

Through its network of some seven thousand miles of integrated pipe lines, connected to more than 200 producing gas fields, our Company is now providing dependable natural gas service to nearly 450 communities in the Gulf South.

UNITED GAS

... SERVING THE *Gulf South*

on top IN OUR FIELD!

Nueces, San Patricio and Karnes counties—all in South Texas—produced approximately 2,674,711 barrels of crude in December, 1950.

Of this volume these companies produced, purchased and pipe-lined 1,100,376 barrels, or 41 per cent of the total.

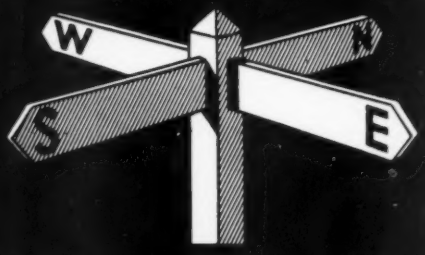
It was gathered, transported, terminaled and marketed through our own facilities, a fact which demonstrates our leadership in the fields where we operate.

SOMICO

Southern Minerals Corporation
Southern Pipe Line Corporation

411 North Broadway **Corpus Christi**

"Serving all Pipelines"



Pipeline Coatings & Wrapping Materials

S. D. DAY COMPANY

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SOUTHWEST Pipe Line PERSONALITIES

Big-inch, long-distance, high-pressure pipe-line transportation was pioneered in the Southwest. The industry developed a highly specialized technique, aided by such men as are briefly mentioned here.

H. H. Anderson, vice president of Shell Pipe Line Co., Houston, joined the company in 1918, and served in various capacities before appointment to his present position. In 1950 he was awarded the American Petroleum Institute certificate of appreciation by its transportation division.

J. L. Burke, president of Service Pipe Line Co., Tulsa, has served the company in various capacities. He is recognized as a leader in advancement of national transportation policies.

Wofford Cain, Dallas, has been chairman of the board of directors of Southern Union Gas Co. since 1943. He was one of the group of men who founded the company in West Texas in 1928 and personally superintended the laying of the first lines. He also served as president of the company from June 1943 until January 1945.

George Coyle was for many years a director and general superintendent of Prairie Pipe Line Co. As a bookkeeper with **Capt. N. V. V. Franchot,** his interest in oil early turned to pipe lining. (Deceased).

M. J. Crose, president of M. J. Crose Manufacturing Co., Tulsa, first entered the pipe-line business in 1930 at Neoga, Ill., with W.K.M. Co., Inc. After working with several other firms, he joined Perrault Brothers, Tulsa, in 1945 as shop superintendent. He left that company in May 1947 to form his own firm.

A. S. Crutcher, secretary and treasurer, Crutcher-Rolfs-Cumming, Inc., was with John E. Morris Co. in 1924 when it developed the crawler-type boom tractor.

J. R. Doles became president of Ajax Pipe Line Corp., Springfield, Mo., in 1945. He began his career in the pipe-line business with Oklahoma Pipe Line Co. in 1909.

Robert S. Ellison served as president of Stanolind Pipe Line Co. and Stanolind Crude Oil Purchasing Co. Teacher, lawyer, and authority on frontier America, he entered the oil industry as legal adviser for Midwest Refining Co., Casper, Wyo. (Deceased).

Laurence H. Favrot, president of Houston Contracting Co., Houston, is 1951 president of Pipe Line Contractors Association. He is a graduate of Michigan University and was associated with Williams Brothers, Tulsa, and Apex Construction Co. before joining Houston Contracting.

W. F. Gates was president of Prairie Pipe Line Co. for several years. He started work in the oil industry in 1884 with West Virginia Transportation Co. as pipe-line gager, railroad conductor, and oil inspector. (Deceased).

Ralph V. Hanrahan, Houston, retired in October 1950 after serving as president of Humble Pipe Line Co. for 29 years. His 49-year career in pipe lining was begun with a job in a construction gang.

William G. Heltzel, consulting pipe-line engineer, was one of the first to develop usable pipe-line-flow formulas. He was formerly vice president and manager of the former Stanolind Pipe Line Co. (now Service Pipe Line Co.).

T. A. Hester, president of Oklahoma Contracting Co., Dallas, entered employ of the company in 1926 after graduating from Cumberland University.

A. N. Horne, former vice president of Texas Empire Pipe Line Co., and former vice president and manager of War Emergency Pipelines, Inc., is vice president and manager of foreign operations for Trans-Arabian Pipe Line Co., with headquarters at Beirut, Lebanon.

Burt E. Hull, former president of Texas Pipe Line Co. and former vice president of War Emergency Pipelines, Inc., recently retired as president of Trans-Arabian Pipe Line Co., San Francisco. He is a Texas A. & M. College graduate, and was elected vice president of The Texas Co. in 1944.

L. E. Ingham, vice president in charge of operations and engineering for Texas Gas Transmission Corp., began his natural-gas experience in 1910 when he joined the engineering department of United Natural Gas Co. in Oil City, Pa. He became associated with Kentucky Natural Gas Corp. in 1939, serving as assistant to the president and then as vice president before the merger of Kentucky Natural into Texas Gas.

Albert C. Johnson, president of Trojan Construction Co., Oklahoma City, is head of a firm which developed 3 years ago from Al Johnson Excavations. The company maintains three spreads and has laid more than 1,436 miles of line.

T. R. Jones, one of the founders of Jones & Braden, is organizer and former president of Oklahoma Contracting Co., Dallas.

Loren F. Kahle is president of Interstate Oil Pipe Line Co., Tulsa, but is residing in Edmonton where he is serving as executive vice president of Interprovincial Pipe Line Co.

Wilson L. Kygar grew up in Ponca City, Okla., with the Marland interests, and some of his first pipe-line work was with Kay County Gas Co. He is now president of Continental Pipe Line Co.

John Leslie Latimer, president of Magnolia Petroleum Co. and Magnolia Pipe Line Co., Dallas, started with the firm 35 years ago. After advancing through the ranks, he became assistant general manager of Magnolia Pipe Line in 1937. A year later he was named a director and vice president of both companies, and president in 1946.

J. Marston Linehan in 1947 became president of Mid-Continent Pipe Line Co., Tulsa. He joined the

firm in 1933 as superintendent of its southern division and in 1944 was named vice president and general manager. He formerly was with the old Prairie Pipe Line Co. and Sinclair Pipe Line Co.

O. Q. Lomax, president of Humble Pipe Line Co., Houston, has had 30 years of service with the company. He was appointed assistant general superintendent in 1937 and elected to the board of directors, named vice president, and general superintendent in 1942.

John B. Manion, Tulsa, retired, was president of Sinclair Prairie Pipe Line Co. and is widely known for his accomplishments in pipe-line operation. As a telegrapher he began in the Pennsylvania oil fields, becoming a pipe-line specialist with the old Standard Oil Co.

John J. McGoldrick, Tulsa, retired, was president of Texas Pipe Line Co. of Oklahoma. He began work as a line walker and pump-station man for old Manhattan Oil Co. at Bowling Green, Ohio, in 1898.

Frank R. McGrew retired as vice president in charge of pipe-line operations for Standard Oil Co. of Louisiana in 1937. He had worked for Eureka Pipe Line Co. prior to joining Standard in 1909. (Died 1946).

R. B. McLaughlin, president of Texas Pipe Line Co., Texas Empire Pipe Line Co., and Texas-New Mexico Pipe Line Co., Houston, has had more than 40 years of pipe-line service. He began his career as a laborer at 16.

Martin Moran, for many years president of Texas Pipe Line Co. of Oklahoma, started as a gager in the 1880's in Bradford, Pennsylvania, field. Several of his sons became prominent in southwest oil operations. (Deceased).

Harry Moreland is president of Great Lakes Pipe Line Co., Kansas City, Mo., the largest products carrier. Starting as a clerk in the pipe-line department of the old Marland Oil Co. in 1920, he was placed in charge of Great Lakes when it was organized in 1930.

C. R. Musgrave, vice president of Phillips Petroleum Co.'s products-pipe-line department, Bartlesville, Okla., formerly worked for the Santa Fe Railroad. He joined Phillips as assistant traffic manager.

J. P. Neill, president of Western Construction Co., Austin, formerly was with Southern Natural Gas Co. In recent years he was vice president of H. C. Price Co., Bartlesville, Okla.

Roy F. Parkhill, president of Parkhill Truck Co., Tulsa, started his firm after World War I, in 1919. Later it was made into a partnership, and in 1940 was incorporated. He has handled some of the biggest stringing jobs in the business.

Calvin N. Payne, one of the founders of Magnolia Petroleum Co., constructed and managed the Payne & McCray pipe line, one of the first crude lines in the United States. He was associated with Standard Oil Co. before moving to Texas in 1897. (Died 1926).

Lewis Perrault, president of Perrault Brothers, Tulsa, first entered the pipe-line industry in 1929 with Hill-Hubbell as a salesman. He left this firm in 1939 to organize the present company.

H. C. Price, Bartlesville, Okla., head of the company which bears his name, started in the pipe-line business in the early 1920's. He is a graduate of Colorado School of Mines.

Eugene L. Rolfs, president, Crutcher-Rolfs-Cummings, Inc., was with Johns-Manville Co. in 1927 when he invented the spiral wrapping machine.

Joe H. Russell has been with the Gulf organization since 1921. In recent years he has directed both oil-production and pipe-line operations, and in 1951 became president of the new West Texas Gulf Pipe Line Co.

N. A. Saigh, president, N. A. Saigh Co., has been contracting pipe-line construction for 25 years, from headquarters in San Antonio.

John B. Sheehan, owner-manager of Sheehan Pipe Line Construction Co., Tulsa, in 1904 helped his father lay an oil line in Kansas. During World War II he was active in Big and Little Big Inch construction.

B. P. Sibole became president of Stanolind Pipe Line Co. in 1942. At 26 he graduated from University of Pennsylvania and became journeyman machinist in Pierce Arrow Motor Co.'s shops. He assumed charge of Sinclair Oil Co.'s motor-transport department in 1920. Stanolind's West Texas system was constructed under his direction. (Deceased).

O. R. Smith, president of Smith Contracting Corp., Fort Worth, first organized to contract pipe-line welding, but his operations soon expanded into full-scale spread operations. He has developed unique techniques for pipe-line welding.

Ray L. Smith, founder of Ray L. Smith & Son, Inc., El Dorado, Kans., began his career with Empire Pipe Line Co. in 1916. His firm has laid several thousand miles of line, including four sections on the Big Inch.

T. E. Swigart has been president of Shell Pipe Line Corp., Houston, since 1940. He was superintendent of Petroleum Experiment Station, Bartlesville, Okla., before joining Shell.

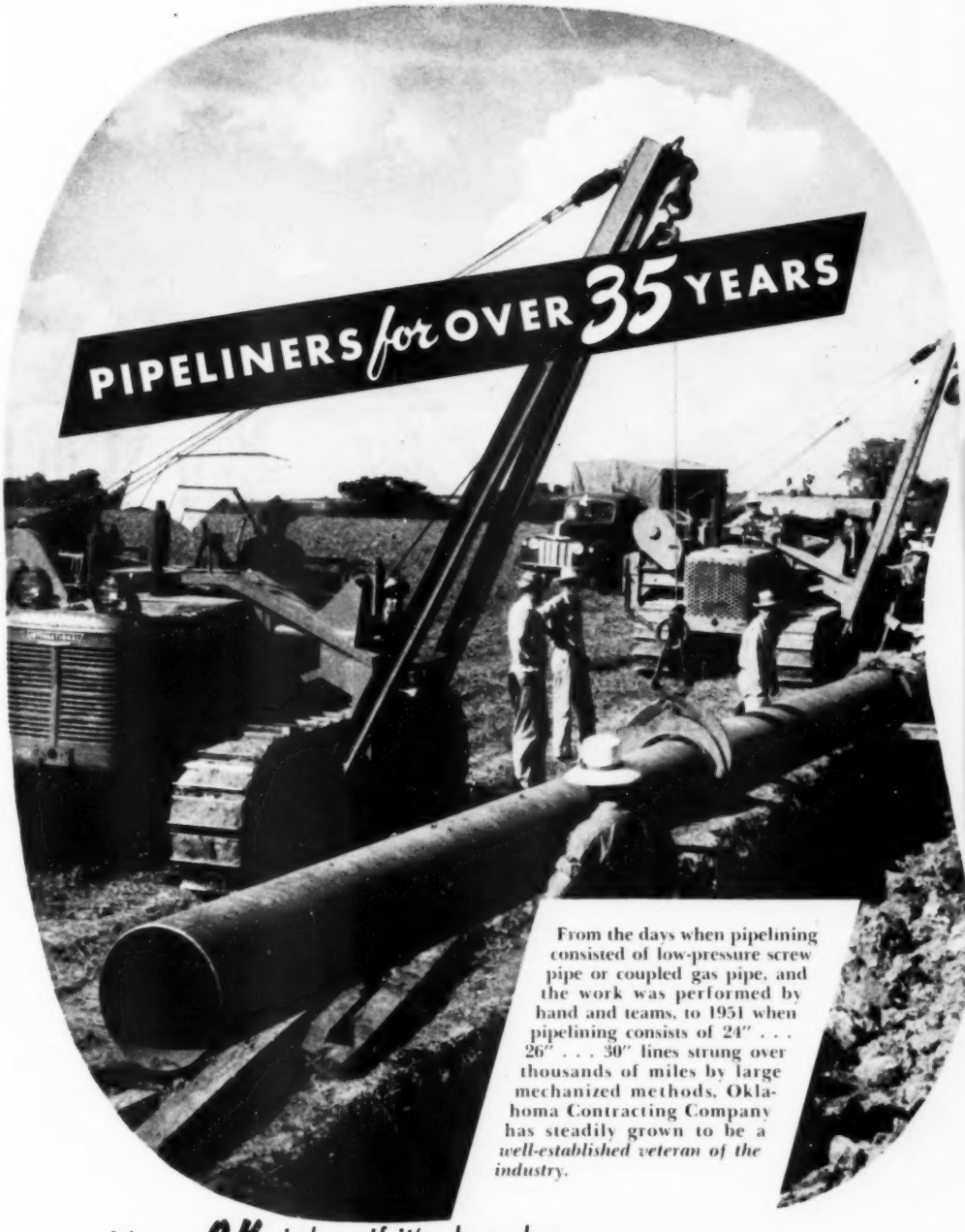
R. J. Tibbets was elected a director and vice president in charge of all crude and products lines for Sinclair Refining Co. in September 1950, with headquarters in Independence, Kans. He had long service with the old Prairie Pipe Line Co. before it was acquired by Sinclair in 1930.

L. H. True, after extensive field experience in pipe lining, became vice president and manager for Magnolia Pipe Line Co., Dallas. He directed construction of the firm's Corsicana, Tex.-Patoka, Ill., line, which was the first continuous big-inch crude-oil system of the postwar period.

Ira O. Walker, president of Pan American Pipe Line Co., Houston, was in Venezuela with Lago Transportation Co., and in Louisiana with Shell Oil Co. before joining Pan-American in 1936. He became president last year.

S. Miller Williams, Jr., and **David R. Williams** have been associated in pipe-line construction and other activities. They started contracting more than 30 years ago in Oklahoma. Subsequently their operations have become world wide.

Robert Thomas heads Texas Louisiana Contractors, Fort Worth. For a long period he was associated in the management of O. C. Whitaker Co. He also heads Gulf Southern Contractors.



From the days when pipelining consisted of low-pressure screw pipe or coupled gas pipe, and the work was performed by hand and teams, to 1951 when pipelining consists of 24" . . . 26" . . . 30" lines strung over thousands of miles by large mechanized methods, Oklahoma Contracting Company has steadily grown to be a *well-established veteran of the industry.*

It's an **OK** *Job . . . If it's done by . . .*

Oklahoma Contracting Company

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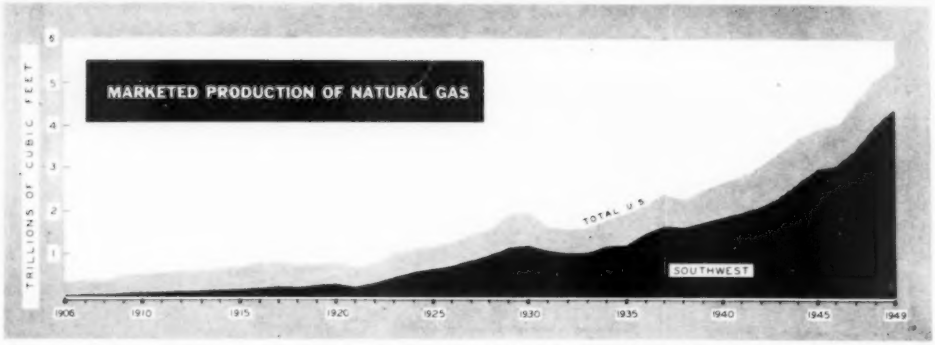


Growth of marketed production of natural gas in Southwest with that for entire United States. (All volumes measured at 14.65 psi.).

Natural Gas Newest of

THE dramatic story of the development of the natural-gas reserves and the major integrated gas companies in the Southwest from the days of Spindletop to the present day lends itself into a discussion of three major periods: the Mid-Continent era which predominated from Spindletop to about 1920; the period of exports when the big Panhandle and Hugoton fields were discovered in the twenties leading to the building of major pipe-line outlets from the Southwest to the North, West, and eastern markets; and the post World War II period which brought Gulf Coast gas to the Atlantic seaboard states following a critical shortage in 1943-1944 in the Appalachian region.

A major shift.—Since Spindletop, the nation has undergone a major shift in the sources of power. When Capt. A. F. Lucas brought in his famous gusher with a "whoosh" that was heard throughout the Western Hemisphere, coal was kingpin, furnished 90 per cent of total United States energy. Water power then contributed about 2 per cent. But the field of hydrocarbons was still the infant in the power picture. Petroleum furnished only 4 per cent. Natural gas supplied about 4 per cent of the total energy requirements of the nation.

At first the rise of natural-gas production was slow. By 1921, this form of energy contributed 4.3 per cent of the total. During 1948, natural gas contributed as much as 14.3 per cent of the nation's energy needs. Coal provided 46.6 per cent, oil 35.1 per cent, and water power 4 per cent.

The Mid-Continent Era

WHEN Spindletop was brought in, there were only local gathering and distribution of natural gas in the Southwest. This was principally in eastern Kansas where small towns were supplied from nearby gas wells.

The first gas discovery in the Mid-Continent was in 1860 near Paola in Miami County. Iola in Allen County followed in 1874. Other Kansas towns supplied with gas were Fort Scott in 1887; Coffeyville in 1892, Independence and Cherryvale in 1893, and Parsons in 1898. Gas wells supplied smelters in Cherryvale in 1898.

Eastern gas men came to the Mid-Continent

Side-boom cat in operation during 1929 on laying of the transmission line of El Paso Natural Gas Co. from Jal, N. M., to El Paso, Tex.

Scene showing cable-tool crews shutting-in an early-day gas well in the Mid-Continent.

the Energy Giants

by Joseph A. Kornfeld

Fifty years ago, natural gas was blown in the air; there was flagrant waste since there were neither important markets nor the system of pipe lines; today, a vast transcontinental network originating mainly in the large southwestern gas reserves brings billions of cubic feet of gas each day to hungry markets from coast to coast.

View of the construction office of Lone Star Gas Co. at Petrolia, Tex., taken in 1914. Note the Wichita truck which was purchased new during the spring of that year. At that time, there were neither paved nor graveled roads anywhere in North Texas. The truck was used mainly for hauling commissary supplies and express packages and mail from Petrolia to the station site and camp.

Welding scene on the 16-in. natural-gas transmission pipe line from Jal, N. M., to El Paso, Tex., laid by the El Paso Natural Gas Co. during 1929.

Welding scene on the first joints of the 30-in. major natural-gas transmission system of Transcontinental Gas Pipe Line Corp. at Laurel, Miss., taken May 23, 1949.

at the turn of the century in search of prolific shallow gas supplies which could serve the principal cities of southern Kansas and western Missouri. In 1904, one group organized Kansas Natural Gas Co. and began building three pipe lines: a 16-in. line from Chanute to the Kansas City area; another 16-in. line from the Chanute area to supply Atchison, Topeka, and Leavenworth, and St. Joseph. A third 16-in. line was built from Independence field in Kansas to supply the lead and zinc-mining business and three cities in western Missouri. A second group, Wichita Natural Gas Co., acquired gas supplies in Independence field and in Chautauqua County. In 1906 they began the construction of a pipe-line system chiefly to supply five cities in Central Kansas. Still a third group supplied the lead and zinc industry in northeastern Oklahoma and southwestern Missouri, competing with Kansas Natural for lead and zinc-mining business.

Early exhaustion of field-gas sources was the major problem that faced these young pipeline companies. This condition prevailed despite the fact that their facilities had been constantly extended as early as 1908 and although ample compression facilities had been built.

Major eastern capital entered the Mid-Continent natural-gas industry in 1912 imbued with the plan to combine production, transmission, and distribution facilities, and to obtain adequate reserves under its control. Integrated natural-gas systems were thus developed such as Oklahoma Natural Gas Co. and Lone Star Gas Co. in northern Texas and southern Oklahoma, and Arkansas Natural Gas Co. in Arkansas and western Louisiana.

In 1912, Henry L. Doherty, the founder of Cities Service Co., purchased control of Wichita Natural Gas Co., Quapaw Gas Co., and Wichita Pipeline Co. The latter firm was a company operated solely in Oklahoma but was owned by the same officials who controlled Wichita Natural Gas Co. The following year, these companies became subsidiaries of Cities Service Co. Two years later Cities Service also acquired Portland Gas & Pipe Line Co.

Doherty firmly believed in the future of the natural-gas business, cognizant as he was of the dismal failures of some early-Mid-Continent gas companies. He employed many crews of surface geologists on whose findings and recommendations large blocks of acreage were leased in Butler County, Kansas. Some of the areas outlined by those geologists were developed into what later became known as Augusta and Eldorado oil fields from which very large amounts of natural gas were supplied to Wichita Natural. The pipe lines of Wichita Pipeline Co. were soon extended into Oklahoma to connect to the fields of Osage County and later extended to the Cushing sector.

Cities Service Gas Co. saw in the discovery of Texas Panhandle field an opportunity to obtain a bulwark of gas supply behind its system for many years in the future. At the same time, it saw the possibility of eliminating a potential threat of a competitive line from that field which could invade the metropolitan markets which Cities Service was serving.

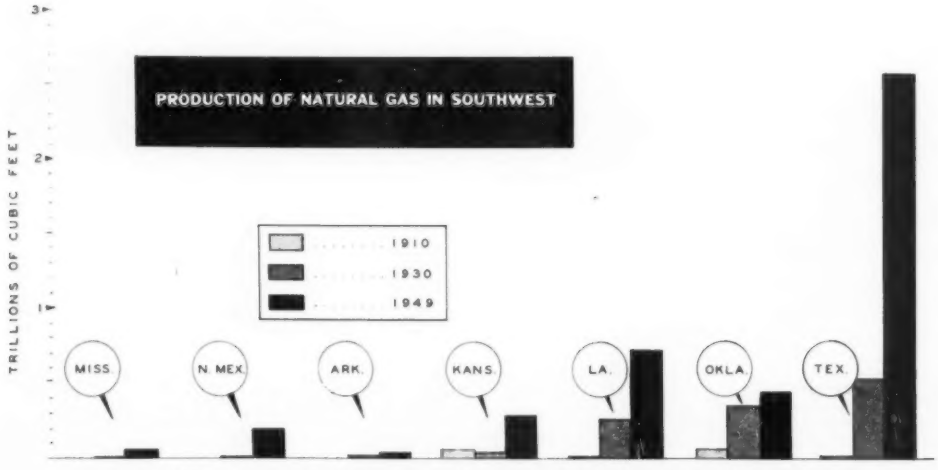
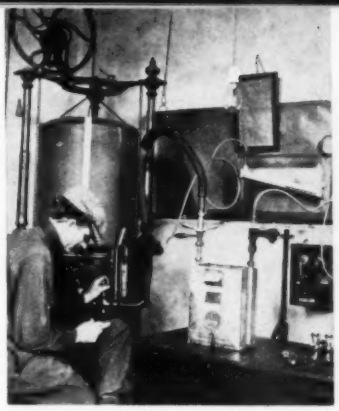
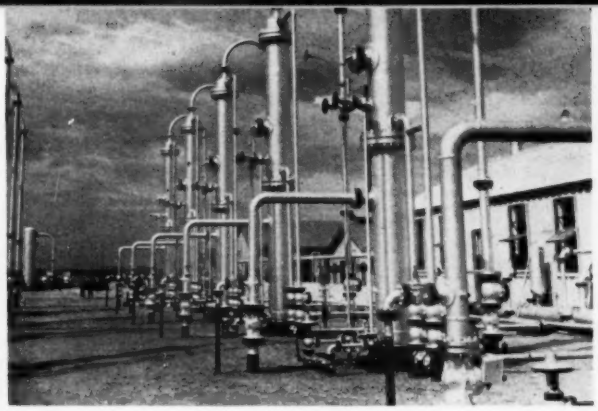


Chart showing volume of production of natural gas in the Southwest by states at intervals from 1910, 1930, and 1949. (All volumes measured at 14.65 psi.).





Left: Early-day gas-meter testing table of Lone Star Gas Co. Right: Early-day process treating vessels for handling sour gas in the Permian basin employed the soda-ash process as shown in the above picture taken at the Jal, N. M., plant of El Paso Natural Gas Co. about 1937. Only 24 in. in diameter, these vessels introduced the use of tube bundles in treating, a practice which remained until 1946 when these units were supplanted by the glycol-amine process.

particularly in the Kansas City area. Accordingly, the firm's management decided to extend its line into Panhandle field. In 1927, a 20-in. diameter line, 250 miles in length, was completed from Panhandle field to Wichita. This represented pioneering on the part of the Cities Service Gas Co. since it was the first large-diameter, long-distance gas pipe line which had been constructed in the nation. This line had an initial daily delivery capacity into Wichita of 70 million cubic feet based on compressor stations located at 60-mile intervals on the new line.

The following year this 20-in. line was extended from Wichita into Kansas City, Mo. Installation of additional compressor equipment increased the capacity of the line to 130 million cubic feet daily for that rapidly growing industrial area. Prior to construction of this addition to its pipe-line system, the firm acquired leases on 119,147 acres in Texas Panhandle field including the famous Burk Burnett ranch lease of 63,880 acres.

Today, Cities Service Gas Co. serves a total of approximately 487,000 domestic customers, mostly through other distributors. Its annual payroll exceeds 4.6 million dollars. Its far-flung system is composed of 5,370 miles of pipe lines, 26 compressor stations with a combined rating of 130,900 hp.; a vast communications system of 3,800 miles of telephone and telegraph lines, 40 warehouses, and a comprehensive automotive transport system.

Eastern Oklahoma. — Back in 1903, in the Osage Nation, J. M. Guffey and John Galey found shallow gas. In that year they laid a 2-in. line from this discovery to a brick plant north of Tulsa. The following year they obtained a 25-year franchise in Tulsa and built a distribution plant to service about 250 customers. In the same area Arkansas Valley Oil & Gas Co. was organized and served 400 customers in Tulsa through its own distribution system. Later the property was sold to Braden and Barnsdall and organized as Osage & Oklahoma Co.

Development of Glenn pool in 1906 brought large quantities of shallow gas without a market. But a group of Tulsa gas men organized Galbreath Gas Co. to pipe gas across the Arkansas River in competition with Osage & Oklahoma Co.; however, the competition failed.

Oklahoma Natural Gas Co. was formed in 1906 to bring gas from Cleveland Okla., to Oklahoma City. The following year a 12-in. transmission line was built from Oklahoma City to Sapulpa, Okla. Here were the beginnings of what was to become a major network of Oklahoma intrastate lines.

About 1910 one of the first compressor stations to be constructed in the Southwest was built at Kellyville, Okla., by Oklahoma Natural.

By 1917 the firm acquired Caney River Gas Co., Galbreath Gas Co., Osage & Oklahoma Co., Oklahoma Fuel & Supply Co., and Vernon Natural Gas Co., and welded these into the largest producing, transmission, and distribution systems in the Sooner State.

An illustrious group of presidents served this organization. They were: Dennis Flynn, 1906-1907; Glenn T. Braden, 1907-1921; Harry Heasley, 1921-1926; R. C. Sharp, 1926-1928; T. R. Weymouth, 1928-1930; E. C. Deal, 1930-1931; E. A. Olsen, 1931-1932; R. W. Hendee, A. E. Bradshaw, and Joseph Bowes.

North Texas.—Meanwhile, foundations were laid for one of the major producing, transmission and distribution systems in the State of Texas. In 1909, Lone Star Gas Co. was organized and the following year a 16-in., 130-mile

Right: Pipe-line construction scene in the swamplands of South Louisiana on the Lirette-Mobile natural-gas transmission line of United Gas System west of Lake Pontchartrain.

Below: This amphibious vehicle, called a "marsh buggy," is especially adaptable to exploration for natural gas in the marshland and bayous of South Louisiana.

line was built from Petrolia field in Clay County to Fort Worth and Dallas. It was a pioneer effort, the first large-diameter, long-distance gas-transmission line constructed in the Lone Star State. Fifteen years were to elapse before any other company constructed a gas pipe line of comparable magnitude in that state.

The first major extension to its distribution system came in 1913 when gas service was provided for five North Texas towns. The following year Lone Star placed in operation a compressor station at Petrolia, the first for Texas.

But the problem of finding increased gas supplies to meet its rising distribution demands forced Lone Star to extend its pipe lines across Red River into Oklahoma about 1917. During the following decade the gas-supply situation in the northern Mid-Continent area was critical and forced extensions of the system to new gas sources. In 1923 it built into West-Central Texas sources and 3 years later reached out to the Texas Panhandle. By 1934, it had tied in the great East-Central Texas fields. Most of its distribution system was built during the late twenties and the early thirties. Today, Lone Star produces one-fifth of the gas used in its system.

On January 1, 1951, Lone Star operated 6,048 miles of transmission and major gathering pipe lines and 7,293 miles of distribution mains. The value of these pipe lines and other property making up the Lone Star network exceeds 201 million dollars. This is a major natural gas system within the Southwest.

Elsewhere in the Southwest, new gas areas were beginning to take form. During 1904 and 1905, natural gas was discovered about 30 miles north of Shreveport by S. S. Hunter. Two years later a 6-in. line about 30 miles in length was built from North Caddo field to Shreveport, forming one of the first natural-gas projects for the Pelican State. In 1909, a similar line was laid from North Caddo field across the state line to the town of Marshall, 40 miles to the west. The same year Arkansas Natural Gas Co. built a pipe line from Caddo field to Little Rock. By the end of the first decade of the new century the mileage of natural-gas transmission lines totaled approximately 300 miles.

The development of the firms that now make up the United Gas system comprises a major chapter in the history of the southwestern natural gas industry.

Palmer Corp. had been engaged in the production of oil in Northwest Louisiana prior to 1915. Palmer discovered gas in Elm Grove field during 1915 southeast of Shreveport; he built an 8-in. pipe line to Shreveport to provide a new source of supply following depletion of North Caddo field.

Monroe field.—During 1916, a major shallow gas reserve was discovered near Sterlington in Northeast Louisiana. This opened one of the largest gas fields in the Southwest. Progressive Oil & Gas Co. 1 Fisher, the discovery well, had

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MANY companies have standardized on Armstrong for every trapping application because:
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Ten years ago, The Tapecoat Company originated the idea of applying coal tar coating in tape form for pipe joint protection.

Coal Tar had long demonstrated its superiority for protecting pipe, and Tapecoat engineers soundly reasoned that a coal tar tape for wrapping pipe joints would provide protection equivalent to the mill coating on the pipe.

The soundness of this idea is more apparent than ever since the natural advantages of this hot coating in tape form have made Tapecoat the leading pipe joint protection in the field today. Distribution engineers depend on it in every state in the country.

While Tapecoat is a joint coating superior to ordinary tapes, *its applied cost is actually lower.* No special preparation of joints is necessary. You don't have to "baby" Tapecoat before or after applying it. One application is enough because it is tough, lasting, abrasion-resisting, built for the rough service required.

Tapecoat is furnished in widths from 2 inches up to 24 inches to meet requirements in protecting welded field joints, mechanical couplings, flanged fittings, bolted and screwed joints, service connections, sleeves and large pipe bends; also pipe under streets, sidewalks and through building walls.

As specialists in pipe joint protection, devoting their time exclusively to the manufacture, sale and improvement of joint coatings, Tapecoat engineers will gladly assist you in working out practical solutions to your corrosion problems. Write today for full details.

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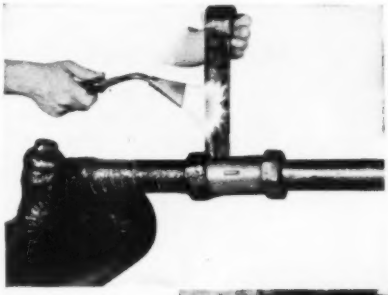

(1) Wrapping coupling on service connection showing use of torch to bleed coating for perfect bond.

(2) Spiral-wrapping of TAPECOAT on elbow of water line.

(3) Mechanical coupling completely protected by TAPECOAT using "cigarette-wrapping" technique.

The TAPECOAT* Company

Originators of the Coal Tar Tape for Pipe Joint Protection

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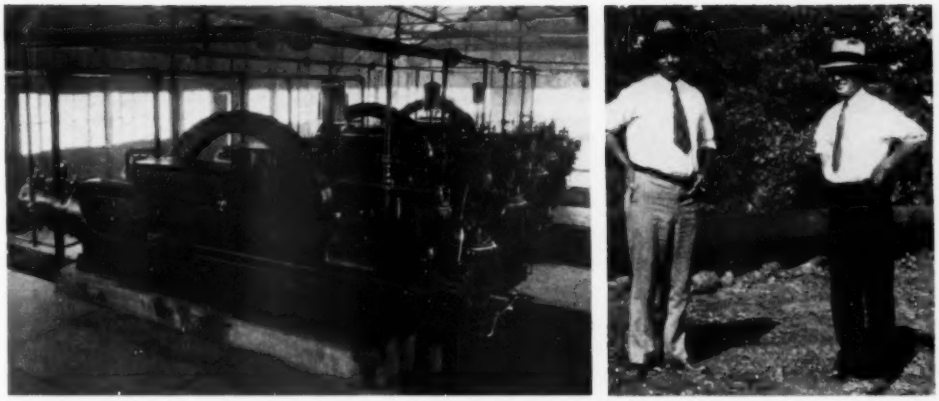


Left: View of initial installation during 1928 of 170-hp. horizontal compressor units at the Fox, Okla., station of Lone Star Gas Co. Right: E. F. Schmidt, vice president, and Julian L. Foster, general superintendent of the transmission division, Lone Star Gas Co., are shown during construction in October 1929 of a 20-in. line from Petrolia to Fort Worth.

an estimated daily open flow of about 2 million cubic feet from 2,300 ft. Only nine gas wells were completed the following year. The field development, however, did not receive its major impetus until 1923 when 120 gas wells were drilled in that field. One of the important field operators at Monroe was the Palmer interests which acquired leases in Ouachita Parish in 1916.

At the time of the field discovery, there was very little market for gas at Monroe. But the finding of large volumes of cheap gas attracted carbon-black operators to the area. As a result the first major phase of utilization was afforded by carbon black which predominated until major pipe-line outlets were built into the field.

One of the major gas sources in the Southwest in the early part of the century was Monroe. The field reached its production peak in 1929 when more than 168 billion cubic feet was produced (measured at a pressure of 10 oz. above 14.4 lb.) bringing the field's cumulative production to more than 1 trillion cubic feet at the end of the year.

Louisiana Power & Light Co., a subsidiary of Electric Power & Light, erected a gas-fired generating plant in 1925 at Sterlington. About the same time, the latter firm acquired several gas-producing companies in Monroe field. In 1928, the gas interests of Palmer Corp. and Electric Power & Light were combined to form Louisiana Gas & Fuel Co.

Meanwhile, Magnolia Petroleum Co. was developing gas production in the Shreveport district in the early twenties. To secure an outlet for the gas a pipe line was built in 1924 from Shreveport to Beaumont. Magnolia also constructed a natural-gas pipe line from North Louisiana to the Dallas-Fort Worth area in 1926-1927.

The Moody-Seagraves interests, primarily interested in the acquisition of gas properties, secured a supply of natural gas in the early twenties in the vicinity of Sinton and Robstown, near Corpus Christi, Tex. A small pipe line was built to serve those communities.

During 1925-26, Moody-Seagraves constructed a pipe line from the Corpus Christi area to Houston, augmenting its gas supply in 1928 with a pipe line from Shreveport to the vicinity of Houston.

Northern Texas Utilities Co. in 1926 started construction of a pipe line from gas fields in the Panhandle of Texas to Wichita Falls and other communities. It was principally a natural-gas development.

Exports From the Southwest

FROM these widely separated and small beginnings was founded United Gas Corp. During the early part of 1930, negotiations were started by United Gas Co. with Electric Bond & Share Co. for the integration of several adjacent, but nonconnected gas units that had been developed in Texas and North Louisiana. As a result United Gas Corp. was organized as a holding company in March 1930.

Up to 1924, the supply of natural gas found in the Mid-Continent fields was utilized within the Southwest. The pipe-line systems were largely intrastate, supplying the needs of cities, communities, and towns located within a short

MISSOURI
ARKANSAS
MEXICO
TERMINAL POINTS OF LINES
El Paso Natural Gas Co. to Blythe, Calif.
Southern Union Gas Co. transmits from San Juan Basin
Kansas-Nebraska Natural Gas Co. to Platte River Valley, Nebraska
Natural Gas Pipeline Co. of America to Joliet, Ill., and Chicago area
Northern Natural Gas Co. to Minneapolis and St. Paul, Minn.
Michigan Wisconsin Pipe Line Co. to Milwaukee, Green Bay, Wis., and Big Rapids, Mich.
Panhandle Eastern Pipe Line Co. to Detroit, Mich.
Texas Illinois Natural Gas Co. to Joliet, Ill.
Trunkline Gas Co. to Tuscola, Ill.
Texas Co. to Russellville Field, Ill.
Texas Eastern Transmission Corp. to New York, N. Y.
Texas Gas Transmission Corp. to Middletown, Ohio
Tennessee Gas Transmission Co. to Buffalo, N. Y., and New England
Alabama Tennessee Natural Gas Co. — Sheffield and Decatur to Huntsville, Ala.
Texas Eastern Gas Transmission Corp. to Delmont, Pa.
Southern Natural Gas Co. to Atlanta, Ga.
Southern Natural Gas Co. to Montgomery, Ala.
Transcontinental Gas Pipe Line Corp. to New York, N. Y., and Greenwich, Conn.
United Gas Pipe Line Co. to Mobile, Ala.
NATURAL GAS
PIPE LINES
OF THE SOUTHWEST

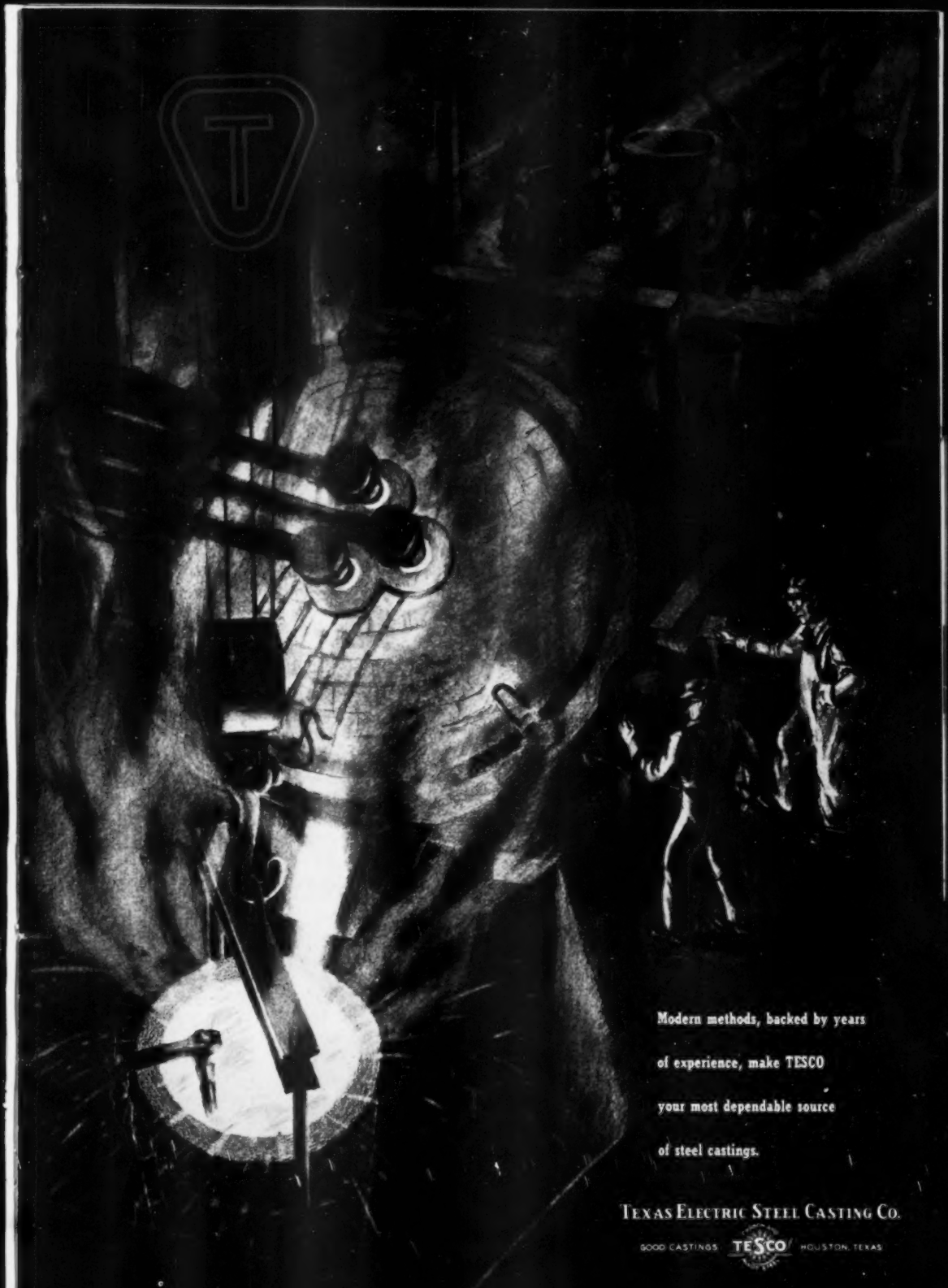
distance of the gas fields. But with the discovery and development of major gas fields in the twenties, such as Hugoton and the Panhandle areas, the Southwest gas industry emerged rapidly into a second major phase. Coupled with these discoveries was the development of high-tensile-strength, thin-wall, large-diameter transmission pipe. This made possible the export of huge volumes of natural gas from the Southwest to markets in the East and the West.

The first high-tensile-strength large-diameter natural-gas-transmission pipe line was built during 1927 for Dixie Gulf Gas Co. in Louisiana. The line comprised 16, 18, and 22-in. pipe and extended for a distance of 252 miles. Longitudinally, it exhibited a yield strength of 60,000 psi. and an ultimate of 65,000 psi., circumferentially, the yield strength was 46,000 psi., and the ultimate was 65,000 psi. During the ensuing 4 years, A. O. Smith Corp. produced 1,111,000 tons of high-tensile-strength line pipe ranging in size from $8^{5}/_{8}$ to 26-in. o.d., a productivity which enabled many major transmission lines to be constructed.

These developments are related to the discovery and development of the major gas reserves in the Southwest.

Hugoton field. — During December 1919 a wildcat well located a few miles west of Liberal in the southwestern corner of Kansas tapped what is today the largest dry-gas field in the world. The well was Traders Oil Corp. 1 Boles. It found gas between 2,581 and 2,755 ft. and was completed for 7,500 M.c.f. of gas per day in December 1922.

Now the field sprawls across three states. It extends for more than 150 miles from southwestern Kansas into the Oklahoma Panhandle, terminating in the northern part of the Texas Panhandle. Its width ranges up to 35 miles.



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GOOD CASTINGS TESCO HOUSTON, TEXAS

Left: Ceremony at the Cumberland River in Tennessee held on December 4, 1943, commemorating the ground-breaking ceremonies for the original natural-gas pipe-line system of Tennessee Gas Transmission Co. In the immediate right foreground with backs to the camera are Gardiner Symonds, president of Tennessee Gas, and Richard Wagner, president of The Chicago Corp., who at the time was chairman of the board of Tennessee Gas. Right: H. B. McDowell, division superintendent, Tennessee Gas Transmission Co., is shown turning the valve which marked the first deliveries of gas by the natural-gas pipeline system of T.G.T. on November 30, 1944. This scene was taken at the Agua Dulce, Tex., dehydration station where the first gas from the fields was received from the reserves of The Chicago Corp. The latter corporation has been a leader in the discovery and development of natural-gas reserves of the Southwest and in the acquisition of market outlets.

The original recoverable gas reserves as estimated was 29 trillon cubic feet (measured at a pressure base of 14.65 lb. with an abandonment pressure of 25 lb.). The reserve was comprised as follows: Kansas, 15 trillion cubic feet for 51.7 per cent of total; Oklahoma 8.5 trillion for 29.3 per cent, and Texas 5.5 trillion for 19 per cent of total.

The first gas well to be completed on the Oklahoma side of the field was Home Development Co. 1 Allison in Texas County which found gas pay at 2,700 ft. during 1922. Drilling development of the area was slow at first. Only three additional wells were drilled during the period from 1922 to 1929. However, a flurry of drilling happened during 1930 when 107 gas wells were completed in Stevens and Morton counties, Kansas.

From 1930 to 1936, only 25 wells were drilled on the Kansas side of the field due to the lack of market and the depression of the thirties. But by 1945, development assumed major proportions.

In the three-state Hugoton field, there were 3,334 producing gas wells as of July 1, 1950. Division is as follows: Kansas 1,999 wells for 60 per cent of total; Oklahoma 864 wells or 26 per cent, and Texas 471 wells or 14 per cent.

By February 1, 1951, there were on the Kansas side 2,256 gas wells proving 1,428,987 attributable acres, exhibiting a total deliverability of 3,508,693 M.c.f. Monthly runs for January 1951 were 33,156,307 M.c.f. according to the Kansas Corporation Commission. On the Texas side, gas production rose from 36 billion cubic feet in 1947 to 49.2 billion in 1948, soaring in 1949 to 76.7 billion cubic feet.

Panhandle field.—A discovery during 1918 in the Texas Panhandle, was to uncover one of the world's greatest gas reserves. This field contains more than 1.9 million proved acres situated in 10 Panhandle counties. However, of this total, 1.5 million proved acres representing 78 per cent of the total are concentrated in Carson, Gray, Hutchinson, Moore, and Sherman counties.

Nearly 15 trillion cubic feet of gas had been produced to January 1, 1950, from the Panhandle area (measured at a pressure base of 16.4 psig. and a temperature base of 60° F.). Production during 1949 was 970 billion cubic feet of gas.

Major Construction

Although Panhandle field was discovered during 1918, more than 9 years elapsed before any sizable pipe lines were built to take gas from that field other than to furnish nearby markets in towns and cities. Producers who had developed this reserve had no market outlet during the early days. The Texas Railroad Commission has stated that "at one time, there was a billion cubic feet a day of natural gas being flared into the air in Panhandle field. This was because there was no market for the gas. Today, there is negligible waste in Panhandle field."

There was a great clamor for a major pipe line into Panhandle field which would offer a market to producers for the great volumes of

gas that were found during the early days of the field's development. Cities Service Gas Co. met that challenge as discussed earlier in this section.

The second large outlet from Panhandle field was constructed during 1928. Canadian River Gas Co. built a 22-in. line that year to supply the major pipe lines of Colorado Interstate Gas Co. Colorado Interstate transports gas to Pueblo, Colorado Springs, and Denver, Colo., and Cheyenne, Wyo.

Consolidated Gas Utilities Corp. grew out of the development of Panhandle field. Organized on July 25, 1928, in Oklahoma, the firm obtained its principal sources of gas from the Shamrock sector of Panhandle field where it owned its own production. Logan W. Cary, its first president, at one time was chief of the gas operations of Oklahoma Natural Gas & Electric Co. Cary served as president until his death in 1938, and was succeeded by E. C. Joullian who served until January 1, 1948. In turn he was followed by Norman Hirschfield. Consolidated built a 14-in. line out of Panhandle field during 1928 to serve communities in Kansas and Oklahoma.

Panhandle Eastern Pipe Line Co. started construction of a gathering system in Panhandle field during 1930. A 22-in. transmission line was built in that year across Oklahoma into Kansas to tap Hugoton field. The long-distance transmission line to Indiana was then connected to these two gathering systems.

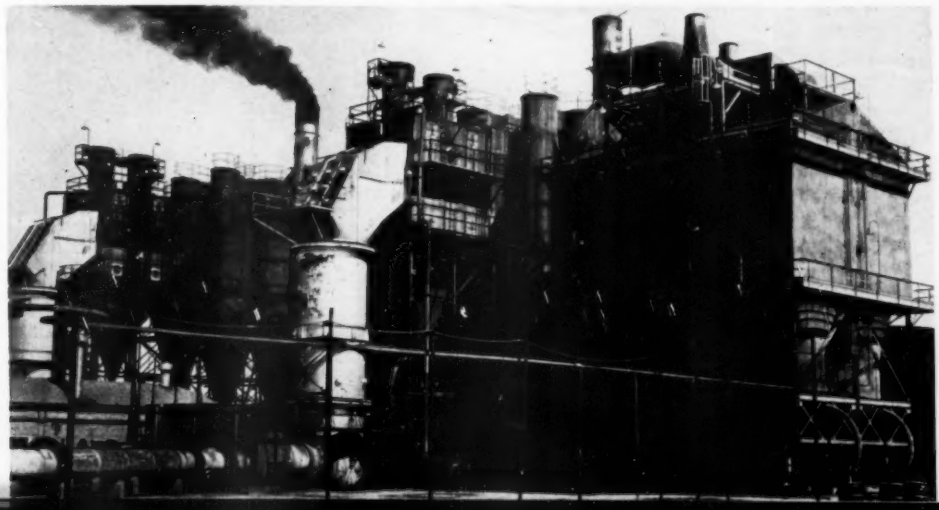
Texoma Natural Gas Co. built a gathering system and a natural-gasoline plant in West Panhandle field in October 1931. A 24-in. line was built to supply Natural Gas Pipe Line Co.

View of the feeder lines and main compressor building at the Louisville compressor station of Texas Gas Transmission Corp. taken soon after the station was placed in operation early in 1950.

of America; the latter also built its own 24-in. line to Chicago.

During 1930, National Tube Co. made major shipments from its Gary, Ind., plant of 24-in. o.d. seamless pipe; this was thin-wall, 5/16-in. material. Circumferentially it exhibited a minimum yield strength of 35,000 psi. and an ultimate of 62,000 psi. This pipe was furnished for the Texas-Chicago line of Continental Construction Corp.; the first length was laid on August 22, 1930, and the last length on August 5, 1931. From that time forward, large-diameter

Exterior view of the furnace-black plant of Cabot Carbon Co. at Guymon, Okla., in Hugoton field. The square structure on the right is the dustube collector; note the absence of carbon black in the air stream above the dustube collector.



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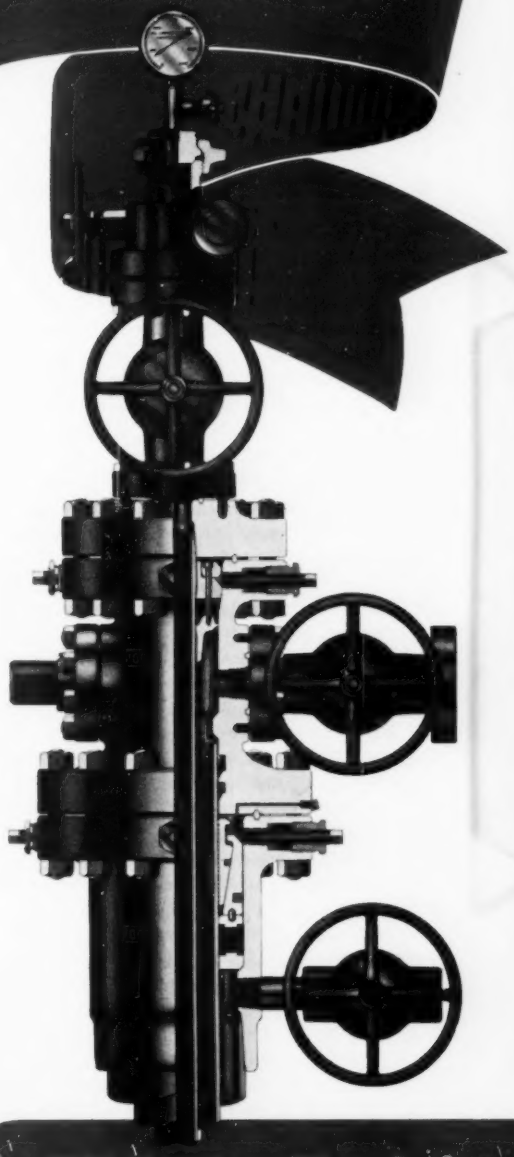

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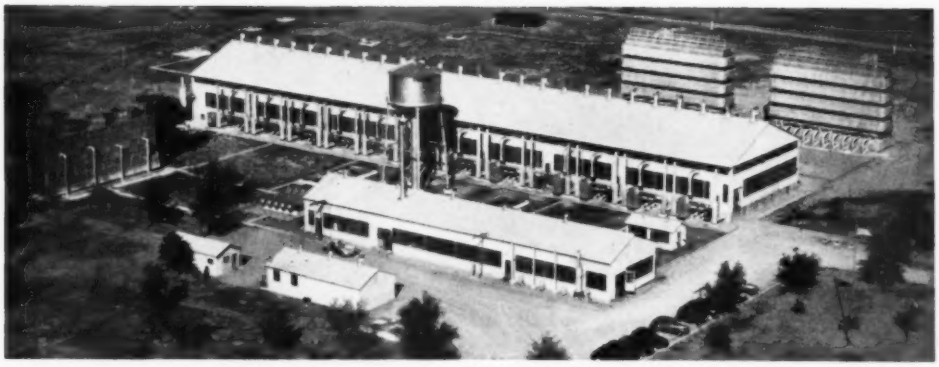


Greensburg, Kans., compressor station of Panhandle Eastern Pipeline Co.

seamless pipe was continuously furnished for major transmission lines.

Panhandle Eastern was one of the pioneer interstate natural-gas pipe-line companies originating in the Mid-Continent oil and gas fields and projected to supply gas to markets located many hundreds of miles away from the areas of gas production.

Shortly after its incorporation, extensive leases of gas-producing lands were acquired in Panhandle and Hugoton gas fields. During the summer of 1930 construction began on a major natural-gas transmission line from Texas to Indianapolis as a possible eastern terminus. Funds were supplied by its parent, Missouri-Kansas Pipe Line Co. The line was placed in operation in the early part of 1932.

Northern Natural Gas Co. was born on April 25, 1930. Three large holding companies—United Light & Railways Co., Lone Star Gas Corp., and Northern American Light & Power—provided the company capital. These companies controlled Northern through ownership of all of the common stock with North American and United Light owning 35 per cent each and Lone Star 30 per cent.

Permian basin.—El Paso Natural Gas Co. was organized in 1928 for the immediate purpose of transporting gas from Lea County, New Mexico, to the area in and around El Paso, Tex. The initial line was approximately 208 miles in length, with a delivery capacity of 36 million cubic feet per day. Deliveries to El Paso were commenced to El Paso in 1929.

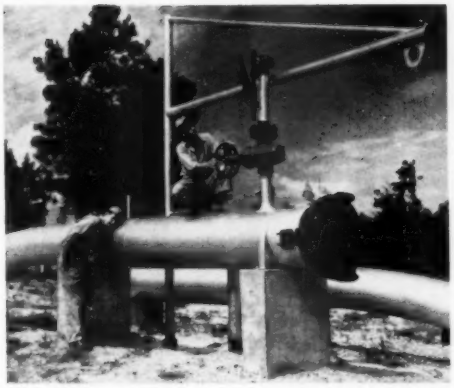
In 1946 and 1947 the company constructed a 26-in. line from the Permian basin to the California border to serve southern California. In 1948, it constructed a 30-in. line parallel to its 26-in. line for the service of northern California.

Today, El Paso has in operation or under construction 5,700 miles of pipe line ranging in diameter up to 31 in. The total investment exceeds 280 million dollars including related facilities. The system brings natural-gas service to 12 million people in West Texas, New Mexico, and Arizona. Together with other companies, it serves California. El Paso is closely knit with the Permian basin and Texas Panhandle fields.

Economic factors that prevented owners of gas reserves in the Southwest from developing these properties hinged principally around price. As late as 1940, natural gas was about a third higher than crude oil and nearly three-fourths costlier than coal on an equivalent heating basis. The reason for this unbalanced cost ratio was due partly to the fact that the price of crude oil had not fully recovered from the sharp drop of the years of the depression of the 30's; this in turn kept the prices of fuel oils and distillate very low.

Competitively, natural gas as a fuel then was not in great demand. The reduced market for the gas discouraged transmission companies from building any appreciable mileage of natural-gas lines. Under this depressed price situation, producers were receiving low prices at the well head. As late as 1943, as little as $2\frac{1}{2}$ cents per thousand cubic feet was being paid by transmission companies.

However, in the decade from 1940 to the present day, a combination of several economic factors bridged the gap between the producer and the prospective consumer. In the period from 1940-1942, the price of crude oil rose from $1 to about $1.25 which came closer to reflecting the cost of replacement. This higher price of crude increased the price of fuel oil so that by 1942, natural gas became cheaper than fuel oil. In 1943, coal costs rose over natural gas.



An ingenious engineering development at a new compressor station on the Inch lines is that shown above, where two operators are working on an aboveground scraper trap. This allows Texas Eastern Transmission Co. to clean its lines regularly without interrupting gas delivery.

From that period forward, the clamor for natural gas was unprecedented. The response came from the gas-transmission companies which doubled their pipe-line mileage between 1940 and 1948.

Carthage field.—Considered the fourth largest natural-gas reserve in the nation, Carthage field rose in importance during World War II. Discovered in September 1936, it grew from 19 producing wells in March 1944 to 390 producing wells as of April 1, 1951. The area is about 25 miles in length and 20 miles in width covering more than 500 sq. miles.

The Bureau of Mines has estimated that the Carthage reservoirs contain 7.604 trillion cubic feet of gas. The two main producing zones are the lower Pettit reservoir with an estimated ultimate recovery of 5.044 trillion cubic feet of gas and the upper Pettit reservoir with 2.395 trillion cubic feet. Lesser reserves are estimated for the Hill reservoir with an ultimate recovery calculated at 165 billion cubic feet.

Carthage field has a normal rated gas-outlet capacity of approximately 1 billion cubic feet per day with five major pipe lines serving as outlets for separator and plant-residue gas. These are: United Gas Pipe Line Co., 24-in. line, 142 miles long, with a capacity of 310 million cubic feet per day extending from the Carthage natural-gasoline plant of United Gas Pipe Line Co. to its compressor plant at Sterlington, La.; another United Gas Co. outlet of 22-in. diameter serving northern Louisiana and the Gulf Coast, with a capacity of 50 million cubic feet of gas per day; a third United Gas line, 33 miles long extending from the Carthage plant to Longview where it connects with the Texas Eastern Transmission Corp. former Big-Inch pipe line; and Lone Star Gas Co.'s 14-in., 100-million-cubic-feet per day capacity line to Opelika, Tex.

Post World War Period

BY the middle twenties it was apparent that the Southwest had a large and permanent supply of natural gas in excess of the outlets within that area. Investigations were made as to the possibilities of long-distance transmission of the surplus gas to other areas. While consumers were interested, it was evident that any effort to transmit large quantities to the North and East would have the opposition of the railroads, several strong unions, and the coal interests. Even the artificial-gas people did not look with favor on the introduction of natural gas at that time. This opposition was strong enough in Washington to postpone all plans for construction.

It was not until 1927 that the first long-distance-transmission project got under way. Cities Service, Jersey Standard, and other interests completed plans to build a 24-in. line from the Texas Panhandle to the Chicago area with outlets at intermediate points. The development of the thin-inch pipe, credited to Henry L. Doherty, head of the Cities Service interests, which greatly reduced the tonnage and brought about other savings, was a factor in the decision to build this first big-inch project.

During the thirties other companies were able to get projects under way despite the opposition of competitive fuels and transportation interests. This was followed by major expansion starting in the middle of World War II. By that time the coal and railroad interests had weakened their position by strikes and higher prices, and there was a demand for the extension of natural-gas services in the Middle West and in the East. These developments, plus the discovery of large additional supplies in the Southwest, accounts for the amazing growth in the marketed production of natural gas over the past few years.

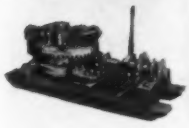
In the Appalachian region, the principal source of natural gas back in 1942 came from the deep Oriskany sand reservoirs. However, from the peak production period recorded in that year, Oriskany gas production in southern West Virginia declined rapidly. The problem of meeting demand in the Appalachian region became a serious one in 1942 and the matter of importing gas from other areas was seriously

LUCEY ROTARY RIGS DRILLED WATER WELLS, THEN OIL WELLS.....

1889

FIRST ROTARY USED TO DRILL AN OIL WELL

1900

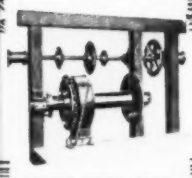


PARKER ROTARY 1900

1911

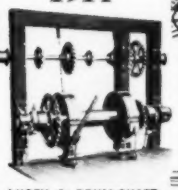
LARGEST ROTARY IN THE WORLD . . . IN 1911

1911



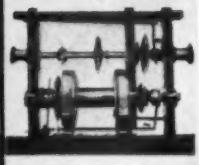
MOGUL SINGLE BAND DRAWWORKS

1914



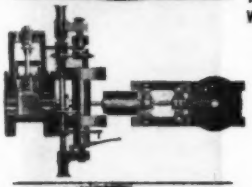
LUCEY 6" DRUM SHAFT, THE LARGEST DRAWWORKS IN THE WORLD . . . IN 1914

1921



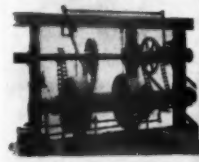
LUCEY 6" DRUM SHAFT, DOUBLE BAND DRAWWORKS

1921



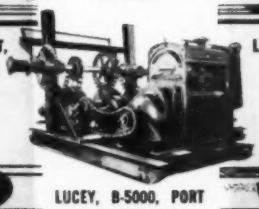
LUCEY SHAFT DRIVE ROTARY RIG

1925



LUCEY B-1500 HEAVY DUTY DRAWWORKS

1925



LUCEY, B-5000, PORTABLE DRAWWORKS

1925

LUCEY B-2000, TRUCK-MOUNTED DRILLING RIG

1927

LUCEY TWO ENGINE PORTABLE POWER UNIT

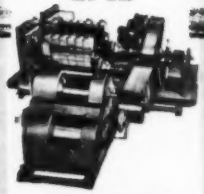
1929

LUCEY B-3000, HORIZONTAL TYPE, THREE SPEED, ROLLER BEARING, DRAWWORKS

1935

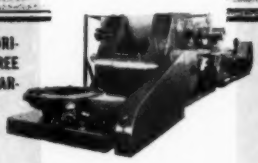
WHELAND, B-3200, UNITARY DRAWWORKS

1941



LUCEY "SLIM-HOLE" DRILLING RIG

1948

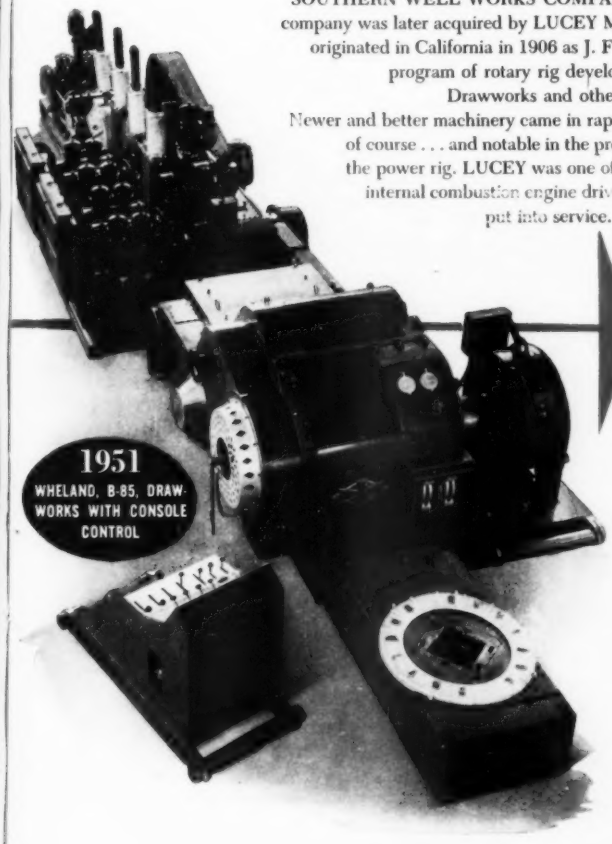


LUCEY AIR-CONTROL DRILLING RIG

. . . . . WAY BACK,

when Gran'pa was a boy!

Several years prior to the completion of the celebrated Lucas well in 1901, water wells and oil wells were being drilled with rotary equipment designed and built by PARKER WELL WORKS COMPANY. The LUCEY story began with the PARKER WELL WORKS which was succeeded by the SOUTHERN WELL WORKS COMPANY, Chattanooga, Tennessee, and Beaumont, Texas. This company was later acquired by LUCEY MANUFACTURING CORPORATION, which corporation originated in California in 1906 as J. F. LUCEY COMPANY. The LUCEY engineers organized a program of rotary rig development that soon made LUCEY Boilers, Pumps, Rotaries, Drawworks and other rotary drilling equipment famous throughout the world. Newer and better machinery came in rapid succession – faster and deeper drilling became a matter of course . . . and notable in the progress of rotary rig development were the unitized rig and the power rig. LUCEY was one of the first to recognize this trend. In 1925 the first LUCEY internal combustion engine driven power rigs and electric driven power rigs were built and put into service. Since that time Diesel Engine Driven rigs have become a dominant factor in oil well drilling.



1951
WHELAND, B-85, DRAW-WORKS WITH CONSOLE CONTROL

It was in 1926 that LUCEY MANUFACTURING CORPORATION was merged with the WHELAND COMPANY (established in 1865) one of the best known builders of Saw Mill Machinery. From that day even greater strides were made in the development of rotary drilling equipment, and today WHELAND Rotaries, Drawworks, Swivels, Pumps and Blocks compare more than favorably with like equipment of other manufacture . . . they're the best

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Scene at the ceremonies attendant the ground breaking at Hungerford, Tex., for the 30-in. natural-gas transmission pipe line of Texas Illinois Natural Gas Pipeline Co., which is under construction from the Texas Gulf Coast fields to the Chicago area.

considered. The accelerated drilling program developed by the major gas companies proved partly successful due to the lack of manpower and the shortage of steel drill pipe. However, the problem of meeting demand requirements was met when Tennessee Gas Transmission Co. on September 24, 1943, received final approval from both the War Production Board and the Federal Power Commission to construct a major pipe line from Texas to West Virginia.

On December 4, 1943, at the height of America's defense efforts in World War II, Tennessee Gas Transmission Co. began construction of its original natural-gas pipe line from South Texas to West Virginia.

This single 24-in. line, completed as a part of the war effort in a record-breaking 11 months, became the nucleus of a system that in only 7 years has grown into one of the nation's major carriers of natural gas.

The severity of the 1944-45 winter season resulted in the curtailment of deliveries to many essential war plants in the Appalachian region. Accordingly to further alleviate the critical supply situation, the Federal Power Commission issued a conditional certificate of public convenience and necessity to Panhandle Eastern Pipeline Co. to install additional pipeline facilities on April 3, 1945, which made 50 million cubic feet of additional gas available in the Appalachian area during the fall of 1945. During the years 1944 and 1945, more than 25 per cent of the gas sold by the company was delivered to Ohio to relieve the shortage of gas in the Appalachian area.

The Government's Big Inch and Little Inch pipe lines were converted to natural gas as an emergency measure to alleviate the fuel shortage in the Appalachian region during the winter of 1945-1946. On December 2, 1945, the War Assets Administration gave Tennessee Gas a letter of intent to write a detailed contract for a 4-month lease and the Federal Power Commission also issued a temporary certificate for transmission of the gas. Three days later, initial deliveries of 50 million cubic feet per day were made through the lines.

Texas Eastern Transmission Corp. was incorporated in Delaware on January 20, 1947, for the specific purpose of bidding for the purchase from the United States of the Big Inch and Little Big Inch pipe lines.

The firm submitted a bid of $143,127,000 on February 8, 1947, to the War Assets Administration accompanied by a certified check for $100,000. The lines were acquired on November 14, 1947, although Texas Eastern operated a substantial portion of these lines under an interim lease between May 1 and November 14, 1947.

Principals of Texas Eastern today are those who initiated operation of the Inch lines during the period following acquisition from the United States. George R. Brown is chairman of the board; R. H. Hargrove, president; E. R. Cunningham, vice president and operating manager; and G. T. Naff, executive vice president.

Texas Gas Transmission Corp., of Owensboro, Ky., is a relative newcomer in the natural-gas industry of the Southwest. The immediate history of the company is traced back to April 9, 1948, when the merger of Memphis Natural Gas Co. and Kentucky Natural Gas Corp. with Texas Gas was completed. In its own right, the predecessor companies of Texas Gas had a 20-year history of supplying natural gas to residential and industrial customers in seven states from Louisiana, Arkansas, Mississippi, and Tennessee in the south, to Kentucky, Indiana, and Illinois in the north. Today, the Texas Gas system comprises 1,501 miles of pipe line with a daily delivery capacity of about 270 million cubic feet.

SOUTHWEST Natural Gas PERSONALITIES

When Spindletop blew in 50 years ago, the gas it brought to the surface was unwanted. Today, natural gas is an enormous and always-expanding industry. Here are some of the men who helped make it such.

Bert H. Bay had been president of Northern Natural Gas Co., Omaha. He joined Cities Service Gas Co. in 1918 and later was named general manager. Before going with Northern Natural, he had been vice president and manager of Panhandle Eastern Gas Co. (Died 1951).

C. Earl Blackburn, vice president in charge of the oil and gas division of J. M. Huber Corp., Borger, Tex., was active in the oil business before graduating from University of Oklahoma, having gained experience in the oil fields. He was named to his present post in 1940.

Joseph Bowes, president of Oklahoma Natural Gas Co., Tulsa, previously headed or held executive positions with electric, gas, transportation, and water-service organizations. He built the first electric-transmission line across Louisiana.

E. Buddrus, president of Panhandle Eastern Pipe Line Co., Kansas City, joined Phillips Petroleum Co. in 1923. He is a graduate of Oklahoma A. & M. College.

D. Harold Byrd, president of Byrd-Frost, Inc.; Byrd Oil Corp.; B-H Drilling Corp.; Plains Production Co.; Four Corners Oil Corp.; McConnell Drilling Corp.; and executive vice president of Inland Refining Co., Dallas, discovered Santa Anna field in Coleman County, Texas. He also drilled the discovery well in Byler pool, Baker gas field, and Shipley pool in Ward County, Texas.

Frank L. Chase, pioneer in distributing Texas natural gas to consuming centers, was president of Community Natural Gas Co., and vice president of Lone Star Gas Co., Dallas. He also served as chairman of the natural-gas department of American Gas Association. (Died 1941).

C. C. Cragin, vice president and general manager of El Paso Natural Gas Co., El Paso, Tex., directs a large pipe-line system operating across the deserts of the Southwest to the California border.

Harold R. Decker, president of Houston Oil Co. and Houston Pipe Line Co., Houston, majored in petroleum engineering at University of Oklahoma, and entered the oil industry in 1925. The company is a large producer of natural gas.

W. A. Delaney, Jr., independent oil operator at Ada, Okla., is president of Louisiana Nevada Transit Co. and Graben Gas & Water Co. He practiced law in connection with oil operations until 1931, and since has been engaged in oil and natural-gas utilities operation.

L. B. Denning was founder and president of Lone Star Gas Co., Dallas. He was a past president of Natural Gasoline Association of America, and had been a member of the national committee on gas conservation during Woodrow Wilson's administration. (Died 1940).

Alex S. Donnelly, vice president, Southwest Division, Honolulu Oil Corp., Midland, Tex., came from an oil family, his father and brothers having worked in Bradford, Pennsylvania, field. In the Mid-Continent area he became a production executive for The Texas Co.

Ray L. Fish, president of Fish Engineering Co., Houston, left the presidency of Stearns-Roger Manufacturing Co., Denver, to become vice president of Tennessee Gas Transmission Co. during its early operations. He subsequently was active in design and construction of systems for Transcontinental Gas Pipe Line Corp., and Texas-Illinois Natural Gas Co.

R. H. Fulton, Lubbock, Tex., owner of the company which bears his name, started building up a construction organization in West Texas in 1940. In recent years he has been engaged in extensive laying of big-inch gas lines from the Southwest.

R. H. Hargrove, president of Texas Eastern Transmission Corp., Shreveport, in 1930 was vice president of all subsidiaries of United Gas Corp. In 1937 he was named vice president and general manager of United Gas Pipe Line Co. and other affiliates.

Robert W. Hendee is president of Colorado Interstate Gas Co., Colorado Springs, Colo. A graduate of Cornell University, he joined Oklahoma Natural Gas Co. in 1921, rising to the presidency in 1932.

George A. Hill, Jr., Houston, was president of Houston Oil Co. and Houston Pipe Line Co. A graduate in law from University of Tulsa, he served as a captain in World War I. He developed large natural-gas reserves for his company. (Deceased).

Norman Hirschfield, president of Consolidated Gas Utilities Corp., Oklahoma City, started his career in the oil industry by working for a firm in financing natural-gas securities. He later joined Arkansas Western Gas Co. and Consolidated Gas.

D. A. Hulcy, president of Lone Star Gas Co., Dallas, reached his present position in 20 years, after beginning as an accountant clerk. He is a member of the executive board of American Gas Association.

H. L. Hunt, Dallas, is an outstanding independent producer with large gas reserves in Texas and Louisiana, and is president of Hunt Production Co. and Panola Pipe Line Co., Dallas. He was a cotton planter, and entered the oil industry when El Dorado pool in Arkansas was opened.

S. B. Irelan, president of Cities Service Gas Co., Oklahoma City, joined Denver Gas & Electric Co. in 1909 after attending Purdue University. He joined Cities Service Power & Light Co. in 1933, and was named president of Cities Service Gas in 1944. He is also a director of Cities Service Co.

Paul Kayser, president of El Paso Natural Gas Co., El Paso, Tex., has put his organization through

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many pioneering developments in the Southwest. Included are extensive gathering and main-line carriers in West Texas and New Mexico, and the big-inch natural-gas line to California. Kayser, who maintains his residence in Houston, is also president of Western Natural Gas Corp.

Fred M. Lege, Jr., was formerly president and director of Magnolia Petroleum Co., Dallas. His earlier success was in natural gas, having been general manager of Galveston Gas Co. in 1908 and president of North Texas Gas Co. (Died 1939).

William G. Marbury, president of Mississippi River Fuel Corp., St. Louis, began with the company as a laborer when construction of its first pipe line began in 1929. He advanced to assistant general counsel, was named vice president in 1945, and elected head of the firm in 1949.

Chester L. May, who has general supervision of all distribution properties for Lone Star Gas Co., formerly was general manager of the old Community Natural-Texas Cities System which became the general division of distribution when Lone Star was reorganized in 1943. He began his career with the firm in Lima, Ohio, in 1910, and in 1917 moved to Texas. In 1921 he was made general superintendent of what was then known as Farmers Gas Co. In 1925, when Community Natural Gas Co. was formed and absorbed Farmers, he was named general superintendent.

N. C. McGowen, Shreveport, head of United Gas Corp., United Gas Pipe Line Co., and Union Producing Co., entered the oil industry in 1913 as an accountant for the Palmer interests in 1913 and assigned to Atlas Oil Co. In 1930 he was named president of United Gas System, and was named president and director of United Gas Corp. in 1944.

John F. Merriam, who this year was named president of Northern Natural Gas Co., Omaha, formerly served the company as executive vice president. He started with the firm as a clerk in 1930, later becoming assistant secretary, assistant to the president, secretary-treasurer, and vice president and treasurer.

L. T. Potter, assistant to the president of Lone Star Gas Co., Dallas, has been with the company more than 18 years. He formerly was superintendent of production and assistant general superintendent of the company's transmission division. He became chief production engineer in 1939 and 2 years later became production superintendent.

J. G. Puterbaugh, president of McAlester Fuel Co., McAlester, Okla., ran a successful distributing agency for coal as his first business venture. In 1931 his interests turned to oil and his company now produces approximately 6,000,000 bbl. of oil annually. Drilling rigs now operate in Arkansas, Texas, and New Mexico.

A. M. Ripple, manager of the natural-gas department of Phillips Petroleum Co., Bartlesville, Okla., is a graduate of Bucknell University. He joined Phillips as a valuation engineer in the natural-gasoline department in 1925, and in 1937 became assistant manager of the gas division. He was named to his present post in 1939.

Herbert H. Ross, vice president in charge of operations for Oklahoma Natural Gas Co., Tulsa, joined Industrial Gas Co. in 1927 after graduation from Ohio State University. In 1941 he was named vice president and general manager of National Gas & Electric Co., and joined Oklahoma Natural in 1943. He became vice president in 1946.

Elmer F. Schmidt, vice president and operating manager of Lone Star Gas Co., Dallas, made significant contributions to techniques of gas measurement. He has been with the company since 1919 and received advancement to his present post in 1935.

F. E. Stanley, president of Midwestern Constructors, Inc., Tulsa, formerly was superintendent for Natural Gas Pipeline Co. of America. His present firm was organized in 1938. Gulfcoast Northern Gas Co., of which he was also president, was merged with Texas-Illinois Natural Gas Co.

D. K. Stephens, superintendent of pipe lines for Panhandle Eastern Pipe Line Co., started working for the company in connection with construction operations. He served as division superintendent until named to his present post in 1938.

L. B. Stewart, president of Drillers Gas Co., Wichita, joined Quapaw Gas Co. at Joplin, Mo., to begin his career in the natural-gas industry. He organized Drillers Gas in 1932.

Minor D. Summers, president of the newly organized MidSouth Gas Co., formerly was assistant to the president of Arkansas Power & Light Co. MidSouth is currently constructing a natural-gas pipe-line system in eastern Arkansas. Summers attended Arkansas Polytechnic College, and entered the gas-utility business in 1928.

Gardiner Symonds, president of Tennessee Gas Transmission Co., Houston, received the 1950 Boston Award for industrial statesmanship. He is a graduate of Stanford University and Harvard School of Business Administration.

A. K. Tyson is president of American Republics Corp., Houston. His master's degree in geology and chemistry came in 1924 from University of Texas. Advancing through various companies, he became vice president of American in 1949, and succeeded the late Craig F. Cullinan, Sr., as president.

E. C. Wagner, president of Canadian River Gas Co., Amarillo, worked for Producers & Refiners Corp., Amarillo Oil Co., and West Texas Gas Co. before joining Canadian River in 1946 as vice president in charge of operations. He was appointed president in 1950.

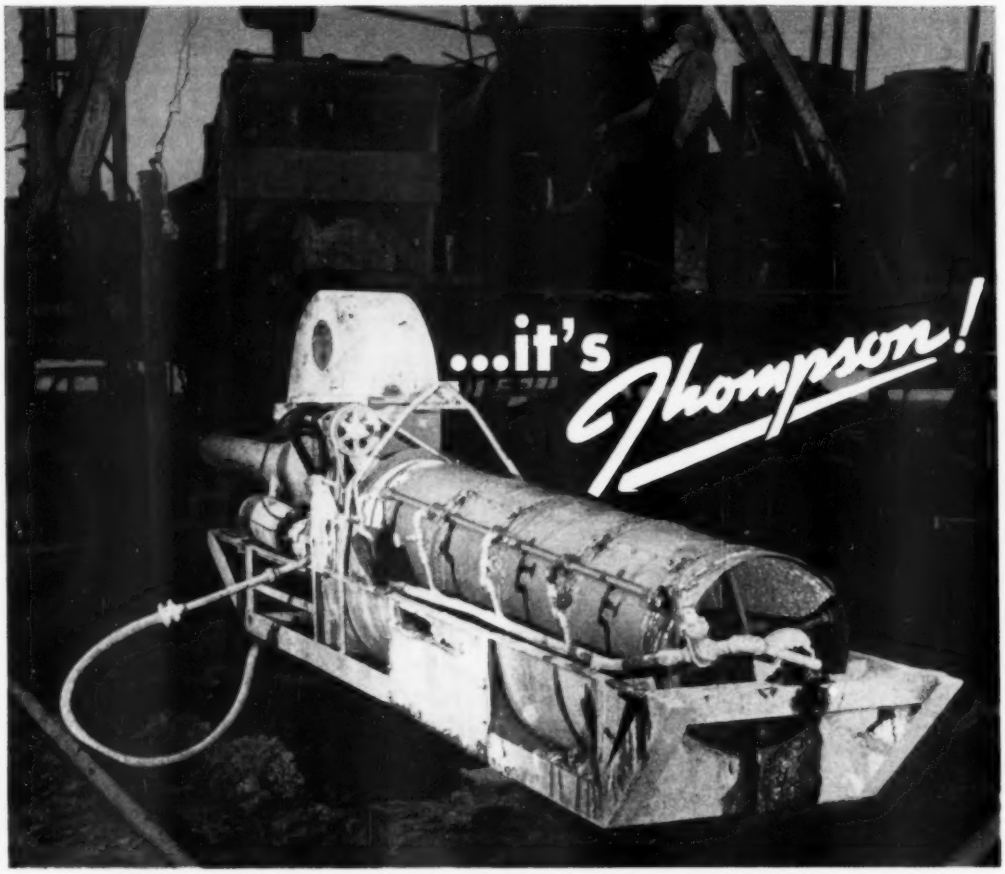
A. H. Weyland, president and general manager of Arkansas Louisiana Gas Co., Shreveport, joined the Cities Service organization in 1919 following graduation from Texas A. & M. College. He was named vice president of the Mid-Continent Oil and Gas Association for Louisiana in 1950.

William H. Wildes, president of Republic Natural Gas Co., Dallas, began his career with E. H. Rollins & Sons, later becoming vice president. He joined Republic in 1935.

Claude A. Williams, president of Transcontinental Gas Pipe Line Corp., Houston, had an attorney's career before entry into the public-utilities field. He heads a company which connects 34 natural-gas fields with the Upper Atlantic marketing area.

George A. Wilson, president of Interstate Natural Gas Co., Monroe, La., became head of the firm in 1946. He formerly served as director of the transportation division of Petroleum Administration for War during World War II.

Clare H. Zachry, president of Southern Union Gas Co., Dallas, joined the company as secretary-treasurer. A former public accountant, he is a director of American Gas Association.



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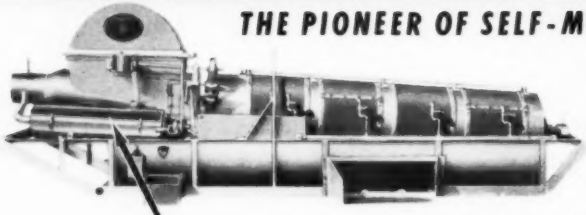

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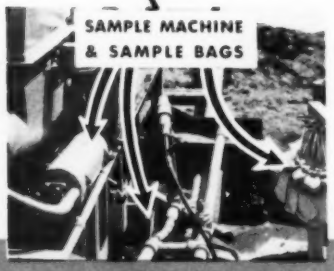
- ECONOMICAL OPERATION
- SAVES DRILLING COSTS



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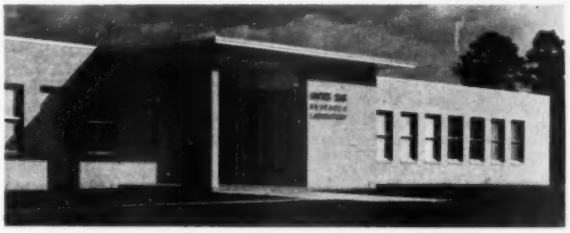
Field research laboratory of Magnolia Petroleum Co. located near Dallas.

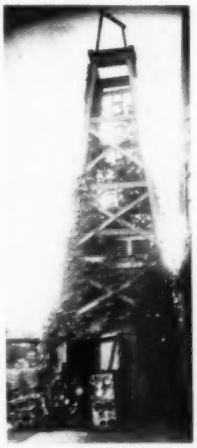
The original (left) and the new production laboratory of Carter Oil Co., Tulsa.



The rapidly expanding importance of natural gas has brought research laboratories to that industry. This one belongs to the United Gas Co., Shreveport.

RESEARCH LABORATORIES of the SOUTHWEST

THE foundation of progress in southwest operations has been research and development. Most of the accepted practices of the past decade in all divisions of the industry have had a background of laboratory studies and experiments often extending over many years. Here are a few representative laboratories of the many in the Southwest which are making the region a center in research and development work.



Left: Rock-bit testing laboratory of Hughes Tool Co. in 1911. Center: Drawing of the company's $2,000,000 metallurgical and research building under construction, Houston. Right: Control laboratory, Baytown, Tex., refinery, Humble Oil & Refining Co., with view of plant in background.

Organizations

ASSOCIATIONS AND SOCIETIES IN SOUTHWEST

TRADE associations and technical societies have had a leading part in bringing about the rapid expansion of all phases of the oil and gas industry in the Southwest. As part of their activities several make special awards for achievements by those closely associated with the industry's operations. These pages include information on associations and societies which either have their headquarters in the Southwest or whose activities in that area are substantial.

American Association of Oilwell Drilling Contractors

Organized—November 1940. Headquarters—321 Reserve Loan Life Building, Dallas. Officers—A. W. Thompson, president; Brad Mills, executive vice president and manager.

Past Presidents—J. E. Brantly, N. H. Wheless, A. H. Rowan, Howard P. Holmes, William T. Payne, J. E. Warren, E. C. Brown, J. S. Morris, and W. S. Churchill.

American Association of Petroleum Geologists

Organized — 1917. Headquarters — 624 South Cheyenne, Tulsa. Officers —Frank A. Morgan, president; J. P. D. Hull, business manager.

Past Presidents—J. Elmer Thomas, Alexander Deussen, I. C. White, W. E. Pratt, G. C. Matson, W. E. Wrather, Max W. Ball, J. H. Gardner, E. DeGolyer, Alexander W. McCoy, G. C. Gester, R. S. McFarland, J. Y. Snyder, Sidney Powers, L. P. Garrett, F. H. Lahee, Frank R. Clark, W. B. Heroy, A. I. Levorsen, Ralph D. Reed, H. B. Fuqua, D. C. Barton, Henry A. Ley, L. C. Snider, Ed. W. Owen, F. L. Aurin, A. R. Denison, Ira H. Cram, M. G. Cheney, Earl B. Noble, C. E. Dobbin, Paul Weaver, C. W. Tomlinson, and C. L. Moody.

American Gas Association—Natural-Gas Department

Organized — Originally organized 1906, and operated as Natural Gas Association of America, with headquarters in Kansas City. Merged with American Gas Association May 10, 1927, and became a department of the American Gas Association. Headquarters—420 Lexington Avenue, New York 17. Officers—D. A. Hulcy, Dallas, president; George H. Smith, director.

Past Presidents (Natural Gas Association of America—1906-1927)—Kerr M. Mitchell, J. C. McDowell, W. H. McKenzie, John M. Garard, A. B. Macbeth, M. B. Daly, E. L. Brundrett, James T. Lynn, W. Y. Cartwright, Jos. F. Guffey, Kay C. Krick, B. C. Oliphant, H. J. Hoover, L. B. Denning, J. D. Creveling, H. A. Wallace, J. B. Corrin, A. W. Leonard, R. W. Gallagher.

Past Chairmen (Natural Gas Section —1928-1944)—N. C. McGowen, S. W. Meals, H. C. Morris, H. C. Cooper, T. J. Strickler, George W. Ratcliffe, Frank L. Chase, John B. Tonkin, Wm. Moeller, Jr., George E. Welker, Robert W. Hendee, Thomas R. Weymouth, E. F. Schmidt, H. C. Hancock, J. French Robinson, Burt R. Bay, R. E. Wertz.

Past Chairmen (Natural Gas Department—1944-1950)—J. French Robinson, R. H. Hargrove, Robert W. Hendee.

American Institute of Mining And Metallurgical Engineers—Petroleum Branch

Organized—1922. Previously a petroleum committee had been organized by Capt. Anthony F. Lucas of Spindletop fame. Headquarters—Continental Building, Dallas. Officers—R. W. French, Cleveland, chairman; Joe B. Alford, executive secretary.

Past Chairmen—Ralph Arnold, E. DeGolyer, F. Julius Fohs, John M. Lovejoy, A. W. Ambrose, J. B. Umpleby, Charles V. Millikan, C. E. Beecher, Earl Oliver, W. E. Wrather, H. D. Wilde, Jr., Harry H. Power, Hallan N. Marsh, M. Albertson, G. B. Corless, W. H. Geis, T. W. Moore, Eugene A. Stephenson, Harry P. Stolz, C. A. Warner, W. S. Morris, M. L. Haider, H. F. Beardmore, Howard C. Pyle, Irwin W. Alcorn, Lloyd E. Elkins, and John E. Sherborne.

American Petroleum Institute—Division of Production

Organized—February 1925. Head-

John Suman, vice president, Standard Oil Co. (N. J.), presents Al Buchanan, drilling contractor, San Antonio, with Distinguished Service Award at annual meeting of Texas Mid-Continent Oil and Gas Association.

Russell F. McFarland, vice president, Seaboard Oil Co., Dallas, presents Fred W. Shield, independent operator, with same award. Other recipients of award given under association listing.

quarters — Rio Grande National Building, Dallas. Officers— J. C. Donnell, II, vice president; C. A. Young, director.

Independent Natural Gas Association of America

Organized—January 1944. Headquarters—918 Sixteenth Street, N.W., Washington 6. Officers—Paul Kayser, Houston, president; John A. Ferguson, executive director.

Past Presidents—E. Buddrus, Joseph Bowes, A. B. Harper, Clyde H. Alexander.

Independent Petroleum Association of America

Organized—June 1929. Headquarters—1437 South Boulder, Tulsa. Officers—J. Ed Warren, Midland, president; H. B. Fell, Ardmore, Okla., executive vice president; Russell B. Brown, general counsel, Washington, D. C.; C. E. Buchner, executive manager, Tulsa.

Past Presidents—Charles F. Roeser, Frank Buttram, Ralph T. Zook, B. A. Hardey, Merle Becker, and Fred W. Shield.

Independent Refiners Association of America

Organized — December 30, 1949. Headquarters—2009 Fannin Street, Houston 2. Officers—Harry Leyendecker, president; D. W. Hovey, secretary-treasurer.

Mid-Continent Oil and Gas Association

Organized—October 13, 1917. Headquarters—308 Tulsa Building, Tulsa. Officers—Jake L. Hamon, Dallas, president; Clarel B. Mapes, general secretary.

Past Presidents — Frank Haskell, J. Edgar Pew, William N. Davis, J. D. Collett, J. C. Hunter, and F. M. Porter.

Kansas-Oklahoma Division

Organized—July 1, 1919. Headquarters—308 Tulsa Building, Tulsa. Officers—T. H. Marshall, Oklahoma City, president; Clarel B. Mapes, secretary-treasurer.

Past Presidents—Frank Haskell, J. F. Darby, Burt H. Collins, H. R. Straight, Wallace C. Franklin, Henry McGraw, J. C. Denton, C. C. Herndon, Alvin Richards, Baird H. Markham, E. R. Filley, Robert S. Kerr, Burdette Blue, L. G. Owen, F. M. Porter, and William T. Payne.

This division grants life memberships to those who have done outstanding work for the industry and the association. The following have been given this honor: William O. Beall, Guy T. Berry, George E. Black, Donald Campbell, Louis Campbell, D. B. Catterlin, W. L. Connelly, J. J. Conry, Fred S. Cook, William N. Davis, R. S. Ellison, W. W. Fleming, Rush Greenslade, Frank Haskell, J. H. Hill, Dana H. Kelsey, Frank B. Long, Peter Q. Nyce, L. G. Owen, C. T. Plake, E. B. Reeser, R. B. Roark, W. F. Semple, Clay Tallman, James A. Veasey, A. J. Wells

Mississippi-Alabama Division

Organized—October 27, 1944. Headquarters—351 Edwards Hotel, Jackson, Miss. Officers—E. B. McGehee, Jackson, president; E. D. Kenna, executive vice president and secretary-treasurer.

Past Presidents—C. L. Morgan, W. M. Vaughey, and James P. Evans, Jr.

Louisiana-Arkansas Division

Organized — 1922. Headquarters — Slattery Building, Shreveport. Officers—A. R. Carmody, president; Samuel B. Caldwell, executive vice president.

Past Presidents—Clyde M. Bennett, J. R. Munce, George O. Baird, M. J. Grogan, C. R. Minor, F. Ray McGrew, J. R. Crawford, D. W. Harris, L. M. Moffitt, Charlton H. Lyons, and A. H. Tarver.

Texas Division

Organized—May 24, 1949. Headquarters—1800 M & W Tower Building, Dallas. Officers—R. B. Anderson, president; Charles E. Simons, vice president and general manager. Recipients of Distinguished Service Awards—J. S. Bridwell, Wichita Falls, Tex.; Wallace E. Pratt, Frijole, Tex.; Gen. Walter B. Pyron, San Antonio; E. DeGolyer, Dallas; Jake L. Hamon, Dallas; John R. Suman, New York City; John F. O'Donohoe, Wichita Falls, Tex.; John C. Pew, Philadelphia; H. R.

RECIPIENTS OF

ANTHONY F. LUCAS MEDAL

Awarded by

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS

J. EDGAR PEW
Sun Oil Co.

H. L. DOHERTY
Cities Service Co.

E. L. DeGOLYER
DeGolyer & M'Naughton

C. M. SCHLUMBERGER
Schlumberger Well Sur.

J. R. SUMAN
Standard Oil Co. (N. J.)

C. V. MILLIKAN
Amerada Pet. Corp.

JAMES LEWIS
Consultant

W. N. LACEY
Calif. Institute of Tech.

W. E. PRATT
Standard Oil Co. (N. J.)

DR. W. E. WRATHER
U. S. Geological Survey

The Anthony F. Lucas Medal, honoring the person responsible for the drilling of the Spindletop discovery well, was established in April 1936. The medal, which is awarded under the auspices of the Petroleum Branch of the American Institute of Mining and Metallurgical Engineers, usually is conferred annually in recognition of "distinguished achievement in improving the technique and practice of finding and producing petroleum." Lucas was one of the founders of the Petroleum Branch.

R. C. ALDEN
Phillips Petroleum Co.

J. W. COWLES
Shell Oil Co.

RECIPIENTS OF HANLON AWARD FOR MERITORIOUS SERVICE TO THE NATURAL-GASOLINE INDUSTRY

Awarded by

NATURAL GASOLINE ASSOCIATION OF AMERICA

G. G. OBERFELL
Phillips Petroleum Co.

DR. G. G. BROWN
University of Michigan

ALOIS KREMSER
Std. Oil Co. of Calif.

DR. E. O. BENNETT
Engineering Consultant

F. P. PETERSON
Mid-Continent Pet. Corp.

M. H. KOTZEBUE
Gaso. Plant Cons. Co.

JAMES E. PEW
Sun Oil Co.

W. N. LACEY
Calif. Institute of Tech.

W. K. WARREN
Warren Pet. Corp.

COL. A. BURRELL
Atlantic States Gas Co.

F. E. RICE
Phillips Petroleum Co.

DR. D. L. KATZ
University of Michigan

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The donor of the Hanlon Award is E. I. Hanlon, chairman of the board of directors of the National Bank of Tulsa. The award, under the auspices of the Natural Gasoline Association of America, is given to those who have made outstanding contributions to the economic and technical developments of natural-gasoline manufacture and related operations.

Hanlon was one of the pioneers of the natural-gasoline industry in West Virginia and later headed the Hanlon companies which had large natural-gasoline interests in the Southwest.

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National Oil Scouts and Landmen's Association

Organized — 1924. Headquarters — P. O. Box 1095, Austin. Officers—William E. Brown, Houston, president; E. J. Raisch, Austin, general secretary.

Past Presidents—B. M. Bell, P. R. Martin, Harry Sampke, W. N. O'Roark, G. R. Nicholson, Ford Turner, J. V. Adams, J. H. Langston, L. S. McGee, T. H. Terry, J. E. Beall, J. L. Bullard, C. A. Strahan, Howard Boyd, L. A. Adams, C. P. Chisholm, C. J. Bardley, J. W. Selby, D. J. Crosby, H. L. Johns, H. F. King, S. S. Stinson, H. R. Brooks, Simon Crites, and S. N. Jackson.

Natural Gasoline Association Of America

Organized—1921. Formerly known as Association of Natural Gasoline Manufacturers. Headquarters—422 Kennedy Building, Tulsa. Officers—John F. Lynch, Corpus Christi, Tex., president; William F. Lowe, secretary-treasurer.

Past Presidents—W. M. Welch, D. M. Buchanan, E. L. Peck, H. A. Trower, E. R. Lederer, S. S. Smith, D. C. Williams, T. R. Goebel, J. A. LaFortune, George P. Bunn, Ray E. Miller, James W. Vaiden, J. H. Dunn, C. R. Williams, and James E. Pew.

Natural Gasoline Supply Men's Association

Organized—May 1928. Headquarters—422 Kennedy Building, Tulsa. Officers—L. L. Dresser, president; William F. Lowe, secretary.

Past Presidents—J. H. Satterwhite, M. F. Waters, M. H. Kotzebue, A. W. Burkett, W. D. Moorer, B. W. Vinson, P. M. Raigorodsky, J. A. Lupfer, G. B. Lane, D. W. McKay, D. E. Fields, A. J. Kerr, W. W. Woobank, L. S. Allen, George W. Probst, Charles D. Peterson, A. M. Buxton, Fred J. Wetzel, John H. Heinzerling, Roy R. Bush, and J. N. McClure.

Petroleum Equipment Suppliers Association

Organized — 1933. Headquarters — —428 Esperson Building, Houston. Officers — Ted Sutter president; H. R. Safford, Jr., executive secretary.

Past Presidents—W. L. Childs, J. A. Crawford, J. A. Geismar, W. M. Morris, John M. Crawford, J. L. Shakely, E. S. Dulin, E. W. Gildart, Earl W. Miller, F. F. Murray, Ferd J. Spang, Hugh H. Glen, Ardon B.

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Society of Exploration Geophysicists

Organized—1930 in Houston. Headquarters—1138 East Thirty-seventh Street, Tulsa. Officers—Sigmund Hammer, Pittsburgh, president; Colin C. Campbell, business manager.

Past Presidents—Donald C. Barton, Paul Weaver, Eugene McDermott, E. E. Rosaire, B. B. Weatherby, L. W. Blau, J. C. Karcher, F. M. Kannenstine, E. A. Eckhardt, W. T. Born, H. B. Peacock, F. Goldstone, R. D. Wyckoff, W. M. Rust, Jr., Henry C. Cortes, J. J. Jakosky, Cecil H. Green, L. L. Nettleton, and George Wagoner.

Southern Gas Association

Organized — 1908. Headquarters — 1922 M and W Tower, Dallas. Officers—Carl H. Horne, Birmingham, president; R. R. Suttle, managing director.

Past Presidents (since 1946)—Frank S. Kelly, Jr., Dean A. Strickland, W. Lee Woodward, and Wister H. Ligon.

Society of Economic Paleontologists And Mineralogists

Organized—1926. Headquarters—624 South Cheyenne, Tulsa. Officers—T. H. Philpott, president; K. O. Emery, vice president; E. G. Lalicker, secretary - treasurer. Past presidents—J. J. Galloway, R. C. Moore, Marcus A. Hanna, J. A. Cushman, Charles E. Decker, G. Dallas Hanna, F. B. Plummer, N. L. Thomas, W. H. Twenhofel, Merle C. Israelsky, Stanley G. Wissler, E. H. Sellards, Gayle Scott, Carey Croneis, Henry V. Howe, Herschel L. Driver, J. Harlan Johnson, Donald D. Hughes, John R. Sandidge, F. W. Rolshausen, James A. Waters, R. Dana Russell, H. B. Stenzel, and W. C. Krumbein.

Texas Independent Producers and Royalty Owners Association

Organized—March 15, 1948. Headquarters—802 Brazos Street, Austin. Officers—R. L. Foree, Dallas, president; E. I. Thompson, Austin, executive vice president.

Past Presidents—H. J. Porter, and Guy I. Warren.

Western Petroleum Refiners Association

Organized—November 1912. Headquarters — 1414 Hunt Building, Tulsa. Officers—R. L. Tollett, Big Spring, Tex., president; J. C. Day, secretary-treasurer.

Past Presidents—W. H. Isom, D. W. Moffitt, H. G. James, E. E. Schock, Pat Malloy, W. D. Richardson, George N. Moore, F. A. Pielsticker, P. M. Miskell, Roy B. Jones, L. R. Crawford, George D. Locke, Howard Bennette, C. M. Boggs, L. B. Simmons, C. L. Henderson, H. T. Ashton, and R. W. McDowell.

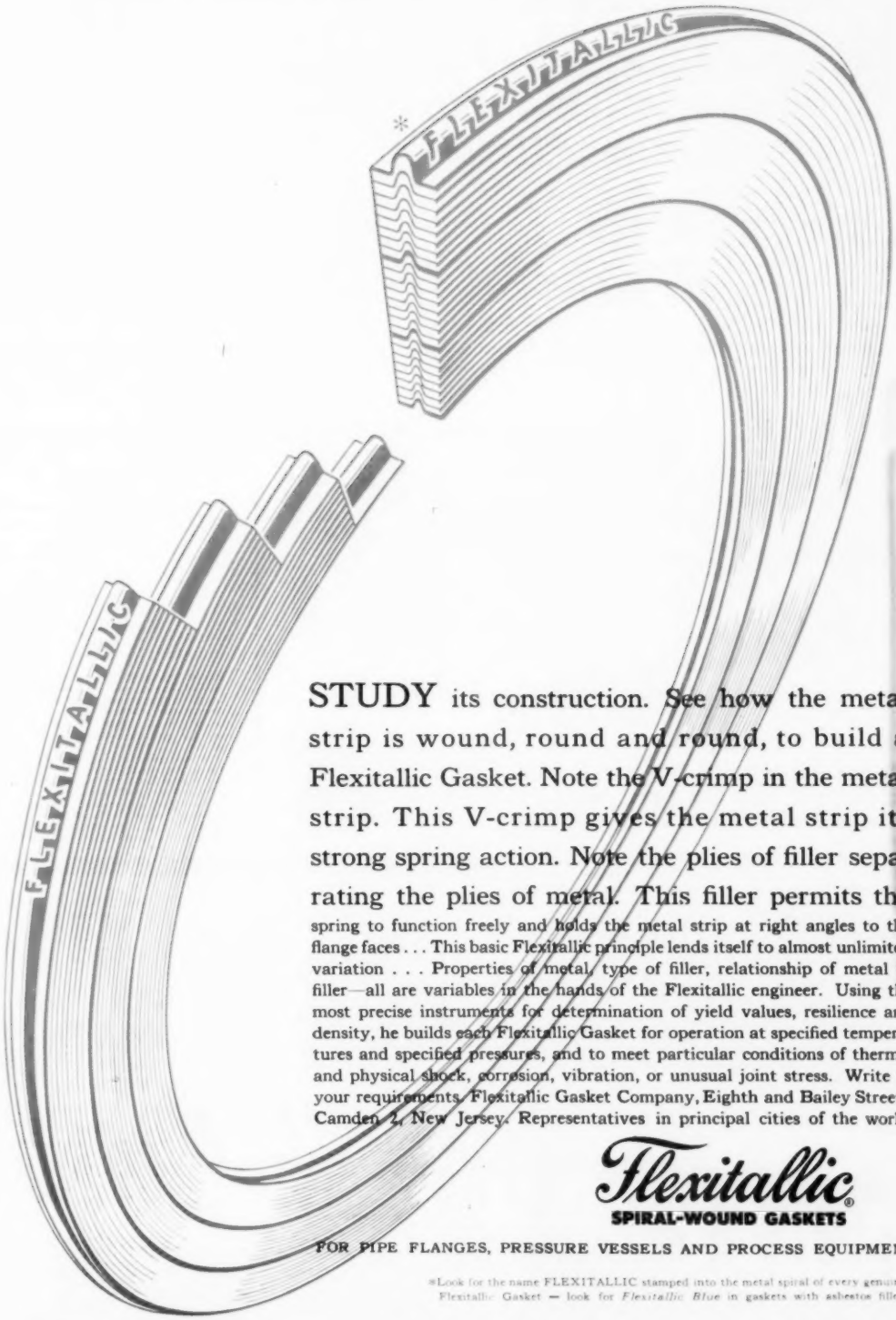
Interstate Oil Compact Commission

Organized—September 12, 1935. Preliminary meetings had been held earlier in the year and in 1934. Headquarters—State Capitol, Oklahoma City. Officers—Allan W. Shivers, governor of Texas, chairman; Earl Foster, executive secretary; Lawrence R. Alley, assistant secretary. Past chairmen — Gov. E. W. Marland of Oklahoma; Ernest O. Thompson; Gov. Leon C. Phillips of Oklahoma; Gov. Andrew F. Schoeppel of Kansas; Gov. Robert S. Kerr of Oklahoma; Hiram M. Dow; Gov. Beauford H. Jester of Texas; Gov. Frank Carlson of Kansas, and Gov. Roy J. Turner of Oklahoma.

The Compact, which now includes 20 oil and gas states, has been approved from time to time by Congress under constitutional authority. The Compact has no power of its own and is in effect an advisory organization to assist in bringing about several definite objectives. The primary purpose is to conserve oil and gas through the prevention of physical waste. Each state obligates itself to enact laws to bring about this objective, although the type of legislation and its enforcement is entirely a state function. Meetings are held three or four times a year for the purpose of expediting the work of several committees and to bring about a discussion of developments of general interest. Compact procedure has been changed and strengthened from time to time, and it is felt that it has been effective in preventing the encroachment of federal authority over oil and gas operations.

The work of the Commission largely revolves around the activities of permanent committees. One of the most important of these is the engineering committee. Its membership includes not only technologists directly connected with the oil and gas conservation departments of the various states but also others who have a special knowledge of

Organization meeting of the Interstate Oil Compact Commission held at Ponca City, Okla., January 3, 1935. Seated: Jack Blalock, Texas; Gov. E. W. Marland, Oklahoma; Robert L. Patterson, California. Standing: Northcutt Ely, Oklahoma; Jeff Davis, Arkansas; John W. Olvey, Arkansas; John S. Farrell, Louisiana; Ralph H. Cummins, Louisiana; Hiram M. Dow, New Mexico; William Bell, Illinois; E. B. Shawver, Kansas; Patrick J. Hurley, Oklahoma; and T. C. Johnson, Kansas.



STUDY its construction. See how the metal strip is wound, round and round, to build a Flexitallic Gasket. Note the V-crimp in the metal strip. This V-crimp gives the metal strip its strong spring action. Note the plies of filler separating the plies of metal. This filler permits the spring to function freely and holds the metal strip at right angles to the flange faces . . . This basic Flexitallic principle lends itself to almost unlimited variation . . . Properties of metal, type of filler, relationship of metal to filler—all are variables in the hands of the Flexitallic engineer. Using the most precise instruments for determination of yield values, resilience and density, he builds each Flexitallic Gasket for operation at specified temperatures and specified pressures, and to meet particular conditions of thermal and physical shock, corrosion, vibration, or unusual joint stress. Write us your requirements. Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey. Representatives in principal cities of the world.

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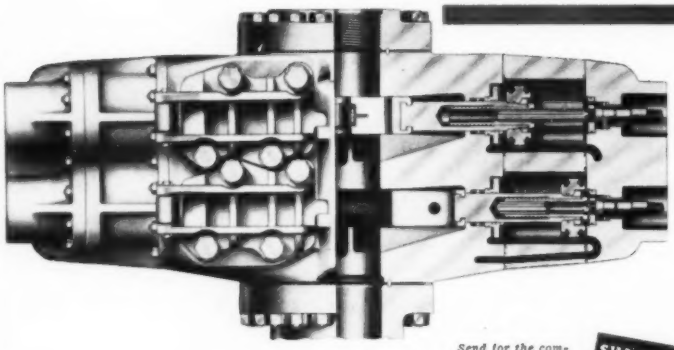

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- Available in both Double (illustrated above) and Single types. Both types provide unmatched compactness—even in sizes as large as 13⅝" (12" Series 900), the Double type provides *two* ram compartments in an overall height of only 30", and smaller sizes require even less space!
- All moving parts are completely enclosed—nothing to become jammed by falling timbers or corroded by chemical muds dripping into the cellar.
- Rams are changed by simply opening side doors, sliding old rams out and new ones in, then closing and bolting the doors. It's unusually fast, simple and convenient.

There are many other important advancements incorporated into the new Shaffer Hydraulic Cellar Control Gates so be sure to get the complete story before you invest in any control gate equipment. Available in a complete range of sizes and pressure ratings!

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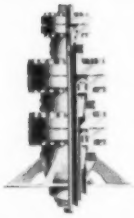

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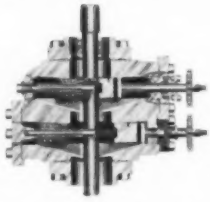
Shaffer also provides a full line of modern Tubing Heads, Multiple Zone Hook-Ups and other equipment to complete your pressure control installation.



SHAFFER MECHANICAL CELLAR CONTROL GATES—known the world over for compactness, simplicity, safety.

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EARL FOSTER

LT. GEN. E. O. THOMPSON

BLAKELY MURPHY

Gov. Allan Shivers is chairman of the Interstate Oil Compact Commission; Earl Foster is executive secretary and in charge of the Oklahoma City headquarters; Lt. Gen. Ernest O. Thompson is chairman, and Blakely Murphy secretary of the legal committee.

petroleum engineering within the states. This includes faculty members from state universities. This committee through the years has conducted several special studies concerned with engineering problems and has made reports which have been of value in furthering the work of the Commission.

The legal committee has also been specially active in making studies, including judicial decisions, and suggesting legislation which will give the necessary legal background to carry on the enforcement of the required conservation regulations. Out of this committee's work has come suggested legislation which has been particularly valuable to the newer oil states in establishing conservation departments. This committee has been able to draw upon the best legal talent of the oil country, including those connected with the faculties of leading law schools which give special attention to oil and gas law.

Other committees whose titles suggest the nature of their work include the bylaws committee, interstate-relations committee, regulatory-practice committee, research and coordinating committee, public-lands committee, secondary-recovery advisory committee, and stripper-well committee. Committees have been appointed from time to time to carry on special investigations.

A small office personnel, headed by Earl Foster, executive secretary, is maintained at the Oklahoma City headquarters. An executive committee meets monthly to further the work of the Commission.

Our aim is to help maintain this Nation's supply of petroleum and to promote progress throughout the industry....

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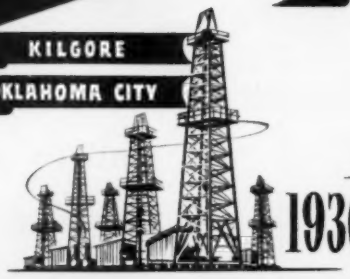
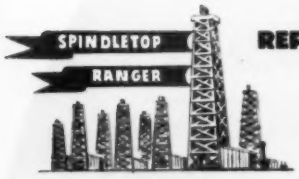


1930
REPUBLIC IS STILL there

REPUBLIC IS



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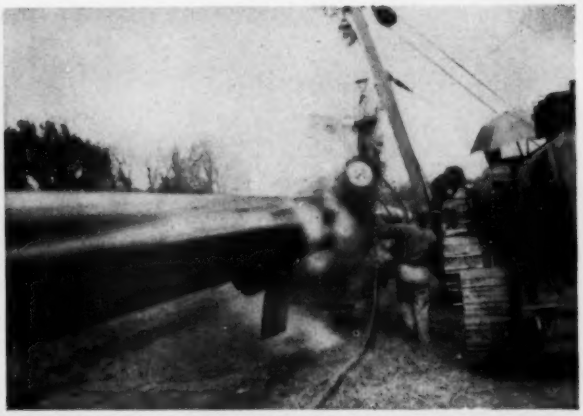

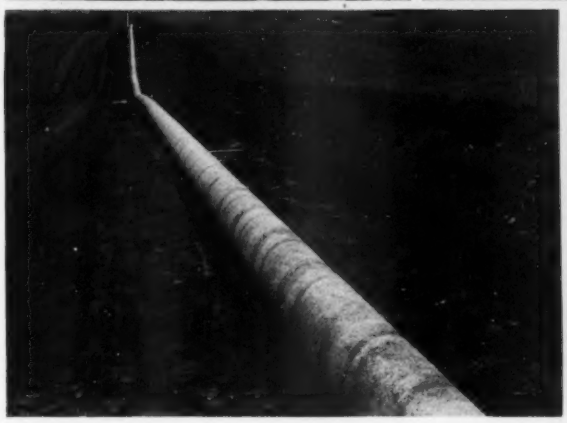

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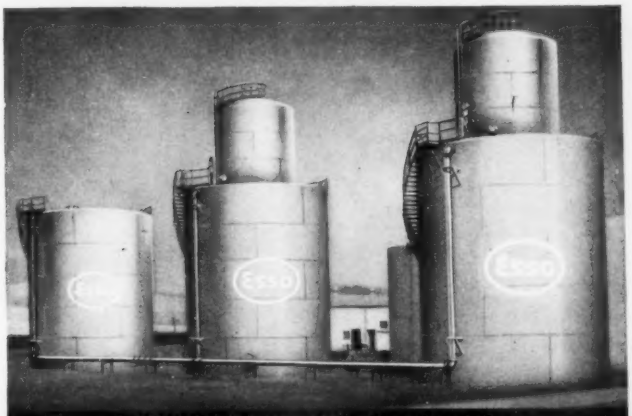

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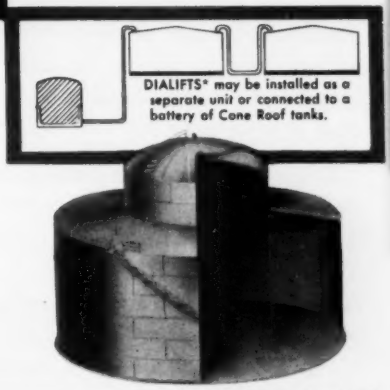

DIALIFTS* may be installed as a separate unit or connected to a battery of Cone Roof tanks.

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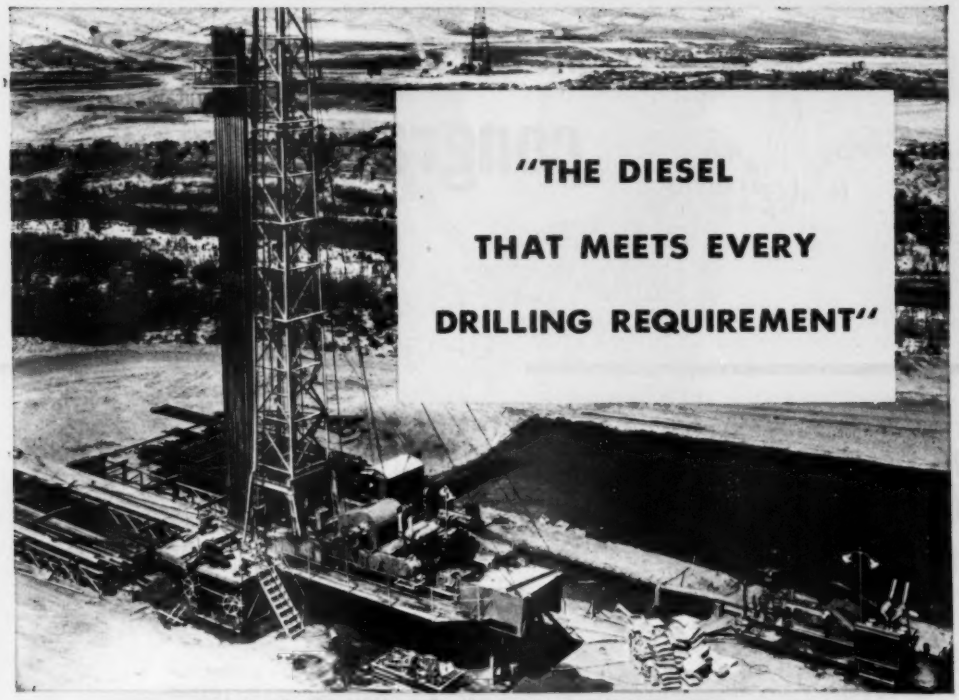

Three GM Series 71 Diesel Twin Sixes, with integral torque converters, drive Ideco drawworks and mud pumps.

OIL well drilling contractor M. H. Stansbury, of Bakersfield, California (who has been drilling in California fields since 1935), writes as follows:

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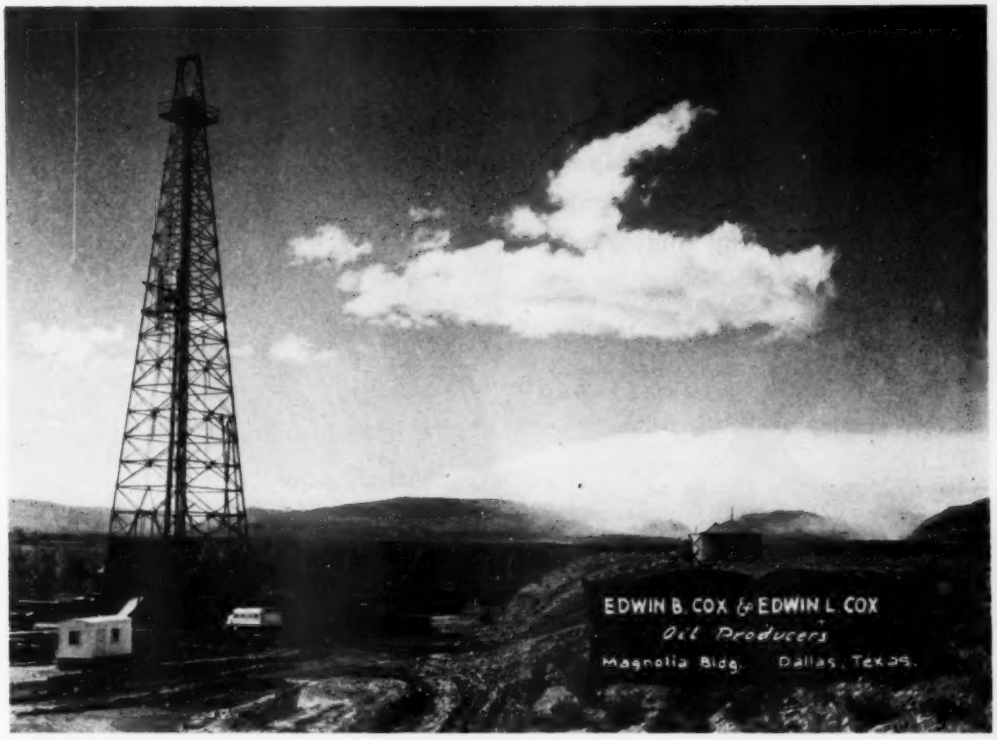
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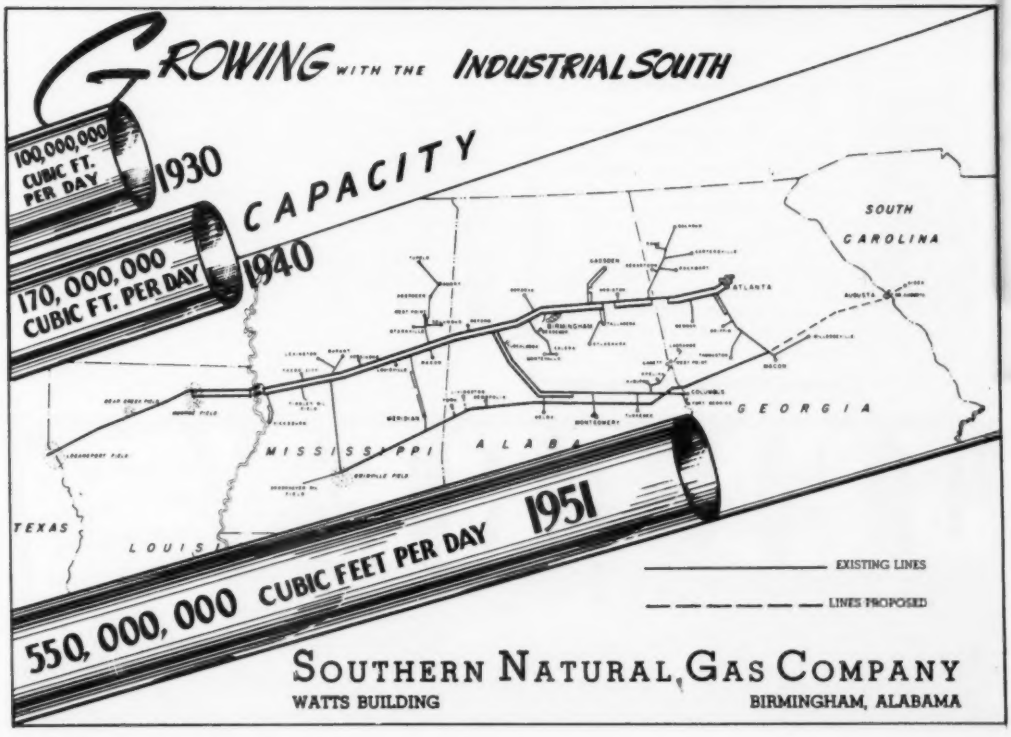
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for Shallow, Deep or Average Drilling
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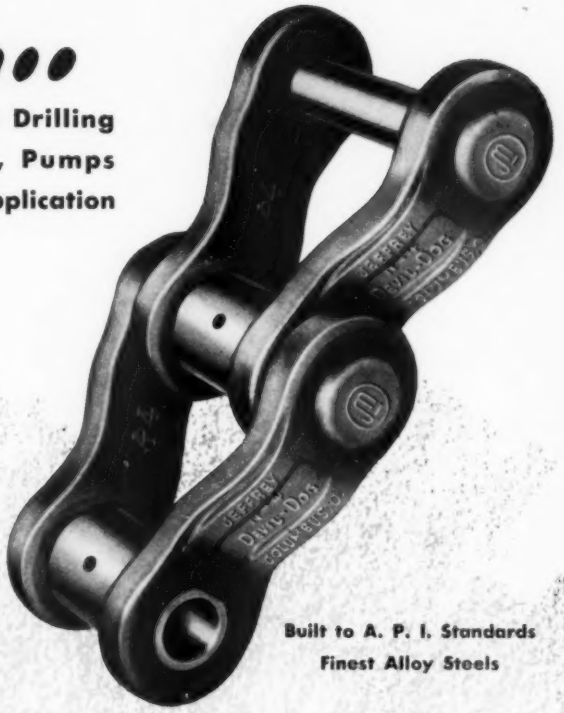

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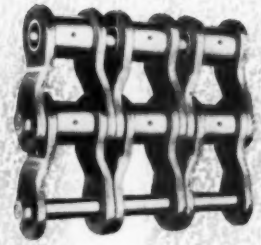

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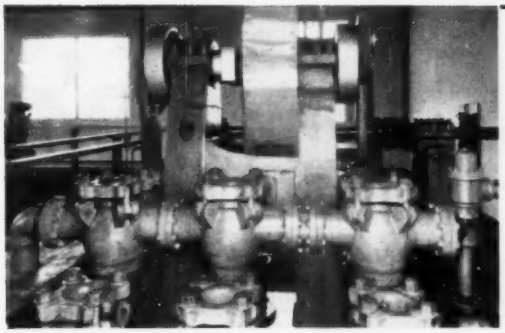

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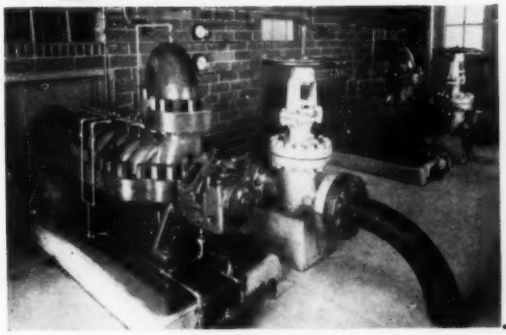

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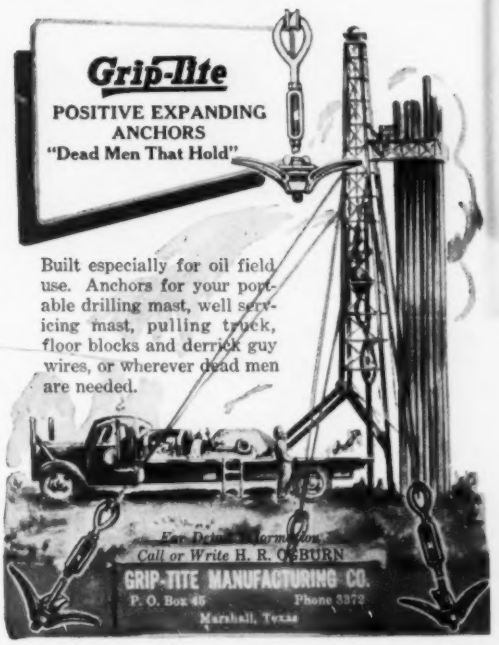

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It is with genuine enthusiasm, therefore, that we present to The Oil and Gas Journal our 50-year pin, in recognition of a half-century of service to Continental and the industry.

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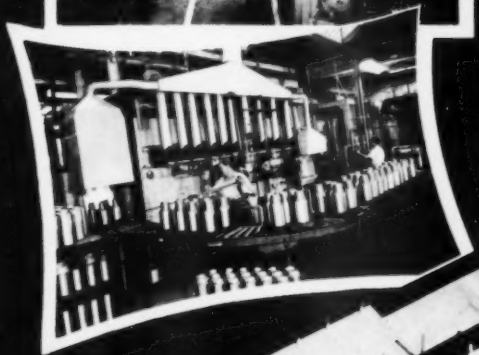
KEEPING PACE WITH A GIANT

AMERICAN IRON & MACHINE WORKS CO.
MANUFACTURERS OF OIL FIELD EQUIPMENT
OKLAHOMA CITY U.S.A.
REG. U.S. PAT. OFF.

27 YEARS

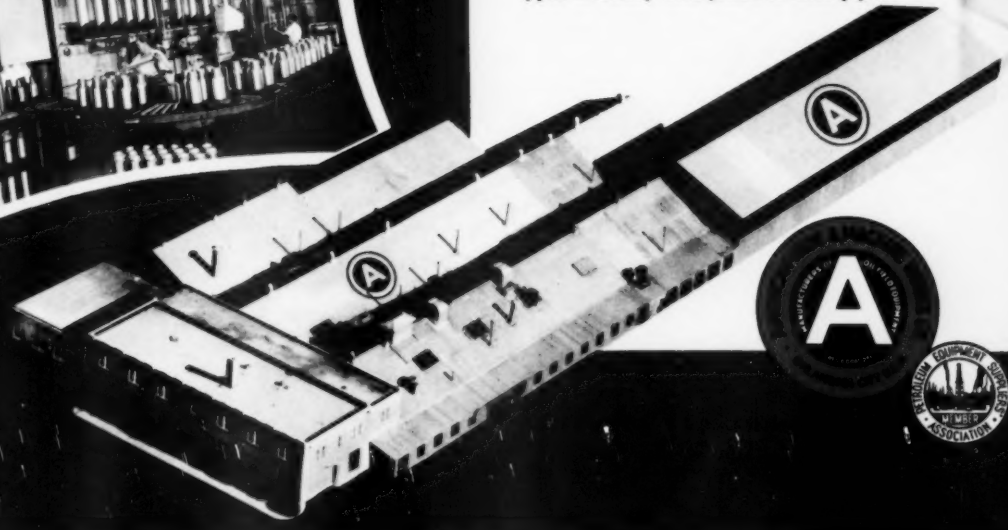


Like the giant it now is—the vastness of the world-wide oil industry makes us humble when we realize the relatively small part our company occupies in it.

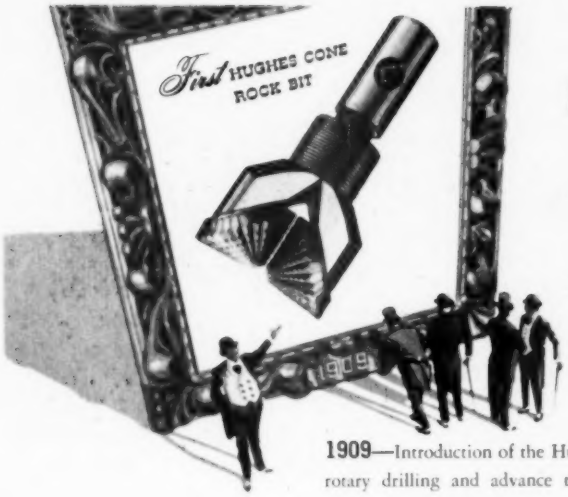
Yet, we feel justifiably proud of the fact that during our more than 27 years of manufacturing activity, we have constantly developed both products and plant facilities to keep pace with its needs!

American Iron Plant No. 1 is both technical and manufacturing headquarters for our outstanding line of oil field equipment. Housed in this plant is American Iron's modern tool joint production line—plus complete machining and heat treating facilities for all American Iron Products.

American Iron Plant No. 2, covering 7½ acres, provides sufficient storage racks for the handling of 1,000,000 feet of pipe. Complete facilities are available for the installation of all types of rotary tool joints to drill pipe.



PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION MEMBER



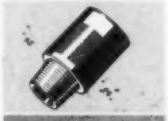
Speaking of Anniversaries...

Here are some important rotary drilling milestones:

1909—Introduction of the Hughes Cone Rock Bit destined to revolutionize rotary drilling and advance the search for oil.

1910—Inauguration of research program to improve rock bit performance.

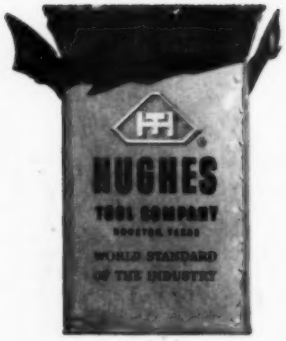
1919—Introduction of the industry's first heat-treated alloy steel tool joint having longer life and greater strength.



1925—Development of the Hughes Acme self-cleaning cone that more than doubled penetration rate of rock bits.

1931—Introduction of first unit type bit with anti-friction bearings, eliminating the delays caused by changing bit cones.

1933—Development of first Tricone bit with interfitting teeth—the most important advancement in rock bit design in its time.



1938—Development of Hughes Flash-Weld tool joints—resulting in the industry's most outstanding drill stem.

1942—Development of Hughes Tricone bits to increase the rate of penetration in hard, abrasive formations.

1947—Introduction of Hughes Tricone OSC-3 bits for faster drilling of soft plastic formations.

1951—Construction of a $2,000,000 metallurgical and research laboratory, further accelerating Hughes' 40 years of continuous research in the field of rotary drilling.